

**BULLETIN**  
OF THE  
**INTERNATIONAL RAILWAY CONGRESS**  
**ASSOCIATION**  
(ENGLISH EDITION)

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[ 388. (06.112) ]

**TENTH SESSION**

LONDON : 22 JUNE-1 JULY 1925

**GENERAL PROCEEDINGS**

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**1st Section : WAY AND WORKS**

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**INAUGURAL MEETING**

**23 June 1925, at 9.30 a. m.**

**PROVISIONAL PRESIDENT, Mr. COLSON,**

**VICE-PRESIDENT OF THE PERMANENT COMMISSION OF THE ASSOCIATION**

Mr. C. COLSON, from the Chair proposed that Mr. E. F. C. Trench, chief engineer of the London Midland & Scottish Railway, be elected president. (*Carried unanimously.*)

Mr. DESPRETS, principal engineer, Belgian State Railways, was elected principal secretary.

Mr. Trench. — Gentlemen, I desire to thank you very much for the honour you have done me in electing me as president of this section.

The next business we have to engage in is the election of the vice-presidents

and secretaries. It is suggested that

Mr. G. A. HARWOOD, vice-president in charge of the construction and development of the New York Central Railroad;

Mr. J. HAUSER, ingénieur, conseiller ministériel of the State Railways, Czecho-Slovakia, and

Mr. A. LINES, superintending engineer (officiating chief engineer) North Western Railway of India,

be elected vice-presidents.

(*Carried unanimously.*)

— The Section then completed its

secretariat and provisionally arranged how its work should be carried out.

**Mr. Trench.** — There are one or two words which I should like to say to you, and I do not propose to detain you for more than a moment, if you will bear with me.

First of all, Mr. Basil Mott, the president of the Institution of Civil Engineers, who is a delegate of the British Government to this Congress is at the moment very busily engaged in piloting through the Houses of Parliament a measure of great public improvement, and I think it likely that he may have considerable difficulty in coming to many of our meetings. I should like, therefore, as a vice-president of this Institution, to say, as I am sure he would like me to say, that we feel gratified and honoured that you have selected this building as the place of meeting for this International Congress. We hope you will find these rooms comfortable and convenient for these meetings, and we offer you all a very hearty welcome. We desire that you should see everything and hear everything that it is possible for us to show you and tell you while you are in this country. We desire that you should feel at home. Our American cousins, with the same language and the same traditions behind them, will feel at home here already, and we hope that before the end of the Congress they will feel still more at home. For you other

gentlemen who speak a different language the case may perhaps be a little different, but I would ask you to remember that we English people are the most inarticulate people in the world; we have difficulty in expressing our feelings in our own language, and in any other language it is for us practically impossible, so I hope you will take it from me that we do entertain towards you feelings of the greatest cordiality and friendship, and we desire to do all we can to make your stay in this country a comfortable and a happy one. Anything that will contribute to the welfare of the railways which have, both in this and in every other civilised country, been the premier means of transportation for many years, and anything that will enable them to maintain that position, will be of value. I have no doubt that there is much in the papers which will be read and discussed here which will be helpful in that connection; but I feel that we should be losing one of the greatest assets of this Congress if we failed to get to know one another better, and to appreciate one another's point of view better than we have done. I hope therefore that the members of this section, at any rate, will take every opportunity of meeting together and discussing things in private as well as in public. (*Long applause.*)

— The meeting rose at 9.55 a. m.

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## QUESTION I-A.

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### MAINTENANCE OF THE TRACK.

*Different methods of maintenance and repair of the track. (By the administration, by contractors, by piece work or premium system. Mechanical appliances, etc.). Comparison from the technical and economical points of view.*

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#### Preliminary documents.

1st report (France), by Mr. R. RUFFIEUX.  
(See English edition of the *Bulletin* March 1925, p. 699, or separate issue [with red cover] No. 26.)

2nd report (America), by Mr. G. J. RAY.  
(See English edition of the *Bulletin*, January 1925, p. 1, or separate issue [with red cover] No. 10.)

3rd report (all countries, except France, America and the British Empire), by

Mr. H. DEYL. (See English edition of the *Bulletin*, May 1925 [2nd part], p. 1663, or separate issue [with red cover] No. 42.)

4th report (British Empire), by Mr. W. H. COOMBER. (See English edition of the *Bulletin*, March 1925, p. 675, or separate issue [with red cover] No. 25.)

Special reporter : Mr. R. RUFFIEUX.  
(See English edition of the *Bulletin*, June 1925, p. 2055.)

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## DISCUSSION BY THE SECTION

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Meeting held on the 25 June 1925 (morning).

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PRESIDENT : Mr. E. F. C. TRENCH, C. B. E.

The President. — Gentlemen, there is, I think, a general desire that we should finish the first subject which we have to discuss this morning, and that there should not be any sitting this afternoon. That has been put to me by Sir Henry Fowler, one of the General Secretaries, and he tells me that that is the general desire.

I do not know whether you agree

that that is the best thing to do? There is a feeling, I think, that with the banquet this evening and with many members of the Congress having engagements this afternoon, it would be better that we should finish the first subject by one o'clock this morning; and if that is your pleasure we will endeavour to do so.

We have a number of most interesting

papers before us, and we have Mr. Ruffieux's admirable summary of those papers. I would ask members who wish to speak to be as brief and concise as they possibly can, in view of the large amount of work which we have to get through and the short time at our disposal. I would also ask the French members of the Congress to speak a little slowly, so that the interpreters may have an opportunity of rendering their remarks into intelligible English.

Perhaps the way in which we shall make the best headway is for the reporters and speakers as far as possible to confine their remarks to such matter in the papers as is new and fresh, and the developments which have taken place since the last Congress in Rome in 1922. There is, of course, as there is bound to be, a good deal of repetition in the reports, but what has struck me in reading them is that there is quite a lot of new matter. There is the great development of mechanical apparatus in America; there are the various methods of economising man-power which have been tried on the Continent; the principal change in this country probably has been the standardization of the permanent way, which has led to modifications in our methods of maintenance as compared with those existing before; and finally there is, where one would perhaps least expect to find it, an entirely new and original method of relaying which has been developed in Ireland, and of which I hope we shall be able to get some description this morning, because it seems to me that it would be of great interest to the members of this Conference.

After these remarks of mine have been translated, I think perhaps the best plan will be for us to read Mr. Ruffieux's summary, and then proceed to

the discussion of the items which are set down in the final summary. (*Agreed.*)

Mr. Ruffieux, *Special Reporter* (in French) then read his special report, which has been published in the « Bulletin of the Railway Congress » for June 1925, p. 2055.

— After reading his paper he received prolonged applause from the meeting.

The President. — The English-speaking members of the Congress will have been able to follow Mr. Ruffieux's summary in the translated edition of the June *Bulletin*; but for the benefit of those who may not have that before them, I think it would perhaps be desirable that we should read in English the summary which appears on p. 2069 of the translated edition of the *Bulletin*.

Mr. L. W. R. Robertson, *Secretary*, then read this summary.

The President. — Before we proceed to the consideration of the final summary, Mr. Deyl has some remarks on the general subject which he would like to make to you.

Mr. Deyl, *Reporter* (in French) then read the following note ;

The study of the question dealt with in my report has shown that there is still considerable scope for progress in the future, especially as regards *the use of scientific principles for controlling permanent way maintenance work*.

It would be very interesting to have full information of the various methods of work in detail, such as the organisation of relaying and maintenance in order to draw comparisons of the results obtained and to utilise the experience gained.

As I have stated in my report, it would appear advisable to investigate experimentally these various methods of deal-



ing with the work and to conduct a systematic examination of the capabilities of various mechanically operated tools and appliances.

The time at my disposal being very limited, I have only been able to complete my report by comparisons of the results obtained by the different methods of organisation in use by the various administrations.

In accordance with the information which has been sent in, some administrations are studying the use of scientific principles for controlling permanent way maintenance work. However, no mention is made of the results obtained or anticipated, as their experience is at present too limited.

Consequently, I have had to confine myself to a few brief remarks on modern systems of organisation or suggested schemes of organisation for maintenance work or relaying used on the Czechoslovakian Railways.

The results of applying « Taylor » principles to the various operations are sufficiently encouraging to warrant tests being made, throughout all branches of railway work, from the workshop to the maintenance gangs. In speaking of « Taylorisation » one must always discriminate between « Taylor's » system applied to the organisation of workshops and « Taylor's » *principles* strictly speaking, which are of course the principles of the economic use of labour and of the time taken for all kinds of technical work.

In view of the different nature of the work performed in the workshops and on the line, there is no doubt that the organisation of the shops can only be applied to permanent way maintenance work with certain considerable modifications.

The principles of economising labour which one can more especially apply to the organisation of this kind of work are as follows :

Scientific investigation of the opera-

tions with the object of discovering efficient methods, adoption of standards, systemised distribution and methodical preparation of the work, choice of supervisory staff who shall have the necessary mental and physical qualifications, choice of the most suitable tools and mechanical apparatus, systematic use of the data obtained and effective supervision and control of the work carried out.

One may base an economic organisation of maintenance work on the following general principles :

1. The adoption of a general programme of annual work;

2. The preparation for the work undertaken, both in the office and on the site of the work, especially as regards a determination beforehand of the condition of the line; the preparation of special programmes of work, the preparation of estimated costs, the engagement of additional labour, etc.

3. The preparation of material, timings of trains carrying the material, the ordering, transport and delivery of the material at the site of the work as required;

4. The economic use of material, the preparation and maintenance of tools and mechanical appliances, the economic use of mechanical devices by means of motor « draisines », etc.;

5. The systematic study of special methods of work on well chosen lines, the adoption of standard methods of output. The systematic examination of mechanical appliances and tools, to determine their capacity;

6. Exact descriptions of the various operations which should be recorded in detail in a notebook or in a report from the foreman in charge, drawing attention to any circumstances which may have reduced the output, especially interruptions of work, such as, time lost going and coming from one place to another, time lost on account of rain, passing trains, etc.;

7. The control of output on the works by means, for example, of graphs or diagrams kept in the office. The comparison of the output, informing the head foreman as regards the results obtained by other gangs with the object of stimulating the output;

8. The keeping of statistics of the cost of maintenance work;

9. The issuing of simple instructions to the foreman in charge, taking into account the exact description of the work to be carried out;

10. The practical training of foremen by special courses and the instruction of the maintenance staff to carry out special work;

11. Encouraging increased output by a system of progressive bonuses.

The principles which have just been quoted serve as a base of the new organisation of maintenance work on the Czecho-Slovakian State Railways, which this Railway is about to gradually introduce.

The experience gained is still too small to allow of me giving any definite information. One can only wait for further results to be able to appreciate the means employed with the object of increasing output and economising labour. It may, however, be added that the staff have been provided with manuals on maintenance work and the special rules dealing with the general revision and repair of the track, and also instructions dealing with the organisation of work, etc. Courses of special instruction for foremen have been organised during the last few years. The graphs mentioned in my report have been in use during the year 1924 and have proved satisfactory. The detailed description of operations mentioned in the daily reports are made by the chief foremen, so that the results may be verified.

Similarly more detailed monthly reports prepared on the daily reports by the chief of the district give for each section separately the average monthly

output. These records are being kept as an experimental measure on a few sections.

At the beginning of 1925, these records of work and the adoption of standardised methods of working have been put in operation on a few sections which have been specially chosen. The Administration is investigating a method of costing maintenance work and is preparing a considerable simplification in the method of keeping these accounts. The statistics should form a basis for establishing the estimated annual expenditure and for showing the results obtained. Statistics kept separately for each line may be used as a basis for determining the bonuses to be paid to the staff concerned, if the total number of hours of effective work is kept within the fixed limit.

I will not go into all the details of the schemes contemplated or very recently introduced, with the object of economising labour. The principal thing is to know the results obtained. However, through lack of experience based on observations over a sufficiently long period, the answer to this question cannot at present be given in a definite manner. I only wish to draw attention to the importance of the question we are dealing with from the point of view of the principles of economy of labour.

**The President.** — Mr. Deyl has given us a fuller summary of this report. I think it would be asking too much of our interpreters to ask them to give it in English at the present moment, but if he will hand that in, it can appear, or at any rate an extract of it can appear, in the *Daily Journal*, and can be translated at leisure.

I think we might now proceed to the discussion of the final summary, and endeavour to arrive at general agreement on the various points which are put before us there. Those of you who have the *June Bulletin* of the Railway Con-



gress will find the final summary on page 2074. Clause 4 of the final summary in the English edition reads as follows : « The proper construction of the formation and superstructure is a *sine qua non* of efficient maintenance work ». That is a proposition to which I think we shall all agree; but if anybody would like to say a word upon it we shall be pleased to hear him.

Mr. Ellson, Southern Railway, Great Britain. — I should like to say a few words regarding the wear of rails. At the present moment in this country, I think I am correct in saying, ordinary high carbon steel is generally used. This is a subject which affects all countries equally with Great Britain.

The President. — Pardon me, but does that come under clause I?

Mr. Ellson. — I thought it came in the latter part : the proper construction of the permanent way is a *sine qua non*. There are other alternatives to using ordinary high carbon steel, and those, I think, are very few in number. The question arises as to whether they could be extended. We have manganese steel, which is a very expensive alternative, but which is adopted in those cases where there is very great wear and tear of the permanent way, as for instance on sharp curves and at points and crossings subject to electric traction. The cost is very high, and I find that compared with the ordinary high carbon steel it costs £4 600 per track mile extra to use this steel as compared with the ordinary steel. There are other metals, as for instance chrome steel, where a percentage of chromium is put into the steel; but this has its drawbacks. We have recently found that it is very easy to get a slight excess of chromium in

the steel, with the result that it renders the rails very brittle, so much so that if you drop them from quite a small height they will break. The cost of chromium steel is an extra of about £530 per mile over the ordinary high carbon steel. Then there is sorbitic steel, which is a heat-treated steel, and which would cost about £270 extra per mile over the ordinary steel. Recently on the Southern Railway we have been faced with the introduction of electric traction, and very shortly that electric traction will be extended very much. The result has been that at some stations points and crossings, which are constructed of ordinary steel, have worn out in nine weeks, and also the side wear on curves has been very great, and we are face to face with the necessity of looking at once into any possible method of extending the life of the steel rails. We find that the side wear on the rails is not uniform, and that it seems to go in waves; there will be a length of a few feet where there is no side wear, and then there will be a length of twenty or thirty feet where there is a very considerable amount of side wear.

There is also one other point which I should like to put. It may not arise upon this, and I do not know, Mr. Chairman, whether I shall be in order in alluding to it. That is the point as to the amount of side wear which is permissible on rails, and the methods which might be adopted...

The President. — No, I think that is not relevant to this.

Mr. Ellson. — Then I will conclude my remarks.

The President. — We are very much obliged to Mr. Ellson for his remarks, but we shall have to guard against

« running off the rails », and I hardly think that the discussion of different materials employed in the track comes within the purview of our discussion. We must, I think, adhere strictly to the terms of reference : « *Different methods of maintenance and repair of the track. (By the administration, by contractors, by piece work of premium system. Mechanical appliances, etc.). Comparison from the technical and economical points of view.* » I think we had better adhere strictly to that definition of the work which we have before us, and not get led away into a discussion on the use of different classes of material, which, however, interesting, are, I think, not quite within the purview of this meeting.

As no speaker has raised any question on item I, I take it that that is agreed. Personally I rather suggest that if the words « and drainage » were added, so that it would read « the proper construction and drainage of the formation and superstructure », that would seem to make it a little more complete; and I think we should probably all agree to that. If you agree, we will pass on to No. 2. (*Agreed.*)

« 2. The standardisation of material is desirable for both technical and economic reasons. »

Mr. Stoika, Roumanian State Railways (in French). — I think that it would be well to be more precise as regards standardisation. Actually, there are administrations who are now occupied in relaying their lines, and it would be useful for them to have rather more definite information. Our administration is considering a suggestion that wagons of 40 to 50 tons should be allowed to run. At the present time we have already petroleum wagons weighing 30

to 40 tons, but we find that certain railways in Europe have built 50 ton wagons.

It would be very useful to have some information on the strength of lines dealing with international traffic on which very heavy wagons may have to run, so that administrations who are relaying their lines may obtain some guidance.

I would propose to add : « It is advisable that lines intended for heavy or international traffic should be constructed to carry axle loads up to at least 20 tons. »

The President. — I am afraid that we can hardly accept that. It does not seem to me that the specifying of proper axle weights is a matter of maintenance of the track.

Mr. Jullien, Paris-Orleans Railway (in French). — I was just going to make the same remark. I may add that the question is under investigation by the International Railway Union, and it would be undesirable for the Congress to deal with it as this might lead to confusion.

Mr. Quinquet, Paris-Lyons-Mediterranean Railway (in French). — The question is moreover outside the scope of this discussion.

The President. — Then may we take it that the second clause as it stands is agreed to? (*Agreed.*)

Then we will proceed to clause 3 :

« 3. It is desirable to reduce as far as possible the time spent in systematic daily rounds of inspection. »

Mr. Tettelin, Northern Railway, France (in French). — I propose to delete the word « daily ». On our railway we do



not make daily rounds of inspection, but weekly rounds, and we do not wish, after 40 years during which this has proved satisfactory, to modify our system as the result of a recommendation of the Congress.

**Mr. Henry**, Eastern Railway, France (in French). — This question was discussed at length at Rome.

**Mr. Tettelin** (in French). — There is no reason why the word « daily » should not be deleted.

**The President**. — This is rather an important point. If the word « daily » goes out, it will be generally accepted that we must reduce the inspection of the line to the lowest possible limit. I do not know whether our English and American colleagues are prepared to agree to that.

**Mr. Tettelin** (in French). — No, but it should be fully understood that the administrations should be free to arrange these rounds of inspection as they consider best. In other words, it is necessary that the frequency of the inspections should remain at the discretion of each administration.

**The President**. — Shall we say « It is desirable to reduce as far as possible the time spent in systematic and periodical rounds of inspection? »

**Mr. Tettelin**. — Yes, I agree.

**Mr. Jullien** (in French). — It appears to me that it is only necessary to say « periodical ».

**The President**. — We can, if you like, suppress the word « systematic ». I do not think that is necessary. We can leave it at « periodical ». Is that agreed? (*Agreed.*)

Then it will read : « It is desirable to reduce as far as possible the time spent in periodical rounds of inspection. »

— Clause 3 thus amended was adopted.

**The President**. — Clause 4 reads as follows :

« 4. It is desirable, either on the knowledge gained by past experience, or by adopting some method of suitably distributing the various elements of maintenance work, to determine exactly the proportion which should exist between labour employed and work done. » That is a translation from the French, and it is not entirely happy. I have no doubt that what it means is that it is desirable in some way or other to proportion the strength of the gang to the work which that gang has to do, whether by an empirical formula or as the result of experience and observation, or in some other way, so as to ensure that one gang is not too strong and the next gang is not too weak. I think that is what it means. Would any member like to speak upon this subject? I think it is one of considerable interest, upon which a good deal of time and thought has been spent.

(The President conferred with some of the delegates.)

**The President**. — A proposal which is now put forward is that the last three lines should read as follows : « To determine exactly the proportion which should exist between the labour employed and the work done. »

**Mr. Ruffieux**, *Special Reporter* (in French). — One could delete the word « exactly ».

**Mr. Dreyfuss**, French State Railways (in French). — One could even delete the whole of clause 4. (*No! No!*)

**The President.** — If no one raises any objection, clause 4 passes, with the omission of the word « exactly ». (*Agreed.*)

« 5. Although the system of carrying out local maintenance work where found necessary is adopted on many railways, the majority of the reporters consider that the system of a periodical general overhauling is the safer and more economical. The two systems are perhaps not so different from one another as might be supposed, both being based on the same principles, although in one case these principles are applied according to the necessities of the moment, while in the other they receive a more systematic application.

In any case, both systems give excellent results in the hands of companies who know how to work them. »

**Mr. Tettelin** (in French). — I agree with this clause, only I would like to point out that the amount of maintenance which is necessary increases with the age of the track.

This is an important point to investigate : After what period of time should relaying be carried out?

I believe that in England it is the practice to renew fairly frequently rails on the main lines, but naturally the shorter the period between relaying the less maintenance work is necessary, and in other words, maintenance is subordinate to relaying. It would be interesting to know what are the ordinary relaying periods on the English railways over which we have had occasion to travel and of which we have formed a very high opinion.

**The President.** — Mr. Tettelin has just said that as the age of the rails became greater, so the maintenance became more onerous, and it was therefore desi-

rable to know whether in England the rails are renewed at frequent intervals, from which it followed that the amount of maintenance work to be done was less; and he asked what was the average life of rails on our English railway systems. I have no doubt that there are gentlemen here who can supply him with that information.

**Mr. Ellson.** — I think that that could be answered by saying that taking the whole of the railways in the country, when an investigation was made two or three years ago it was found that the life was about 39 years; but that conclusion was based not only on main lines and secondary lines, but also on the wear in sidings. I think it would not be far out if one said that somewhere in the region of 20 years would be an average use of a rail on the primary and secondary lines in this country; of course, where the rail is subjected to special conditions, you have a very much shorter life. I mentioned in my earlier remarks that on the electrified lines we are getting only nine or ten weeks' wear. That is where it is subject to special conditions — the heavy unsprung weight which has necessarily to be allowed for in the electrified carriages. The Carriage department find that they cannot get the weight of the motors, transformers and other machinery on to the springs, and it leaves us with something between three and four tons of unsprung weight on each axle.

**Mr. Tettelin** (in French). — The President can perhaps tell us what is the life on his own railway.

**The President.** — Mr. Tettelin, I think, was talking more in general of the average life, not of special cases such as you mention.



Mr. Tettelin. — On main lines.

The President. — I can quite confirm what Mr. Ellson has said, that on the main lines in my experience the average life is somewhere in the region of twenty years, and on secondary lines somewhere in the region of thirty years; so that if you take a general average over the first and second class lines, it would be somewhere about twenty-five years. The main lines and the secondary lines are about equal in length, so that it gives you a general average of twenty-five years.

Mr. Tettelin (in French). — Actually relaying is carried out on the main lines every 20 years.

The President. — That is roughly the case.

Mr. Tettelin (in French). — The result is that for a number of years very little maintenance work has to be done.

The President pointed out that the English text of the first part of clause 5 was not very clear, and proposed an alternative wording.

Mr. Lines, North Western Railway, British India. — On our railway we have a system betwixt and between the two. We have very inefficient labour, so that we have much heavier gangs. We have 2 1/2 men per mile on the main line, and less on the branches. These gangs are divided into 3-mile lengths, and they attend to a length of about one-twenty-fourth of a mile per day. That is to say, they work through one mile per month. The length to which they attend they open out completely, and they pack it up; then the inspector comes along and inspects it during the course of the day, and after the inspection is done they re-box it, and put back

the ballast, and so on. That is a kind of partial relaying, though not so complete as the system given by Mr. Ruffieux.

The President. — Yes, I think that was noted in the text; that in some cases there was a combination of both systems in operation. It is not mentioned in the summary, but I think it was mentioned in the text.

Mr. Lines. — My point is that it seems to me that that wording at the beginning of paragraph 5 is suitable.

The President asked the meeting if the wording of this clause was suitable as regards the organisation on English railways. As no one wished to speak, he declared clause 5 carried.

« 6. The technical processes adopted in the different branches of maintenance work are not uniform. It would be useful if systematic experimental work could be undertaken with a view to determining the best methods of work applicable to each operation, taking into account the advantages to be derived from the use of mechanical appliances.»

Mr. Ferreira, Portuguese Railway Company (in French). — Would it not be better to word this clause somewhat differently? In practice there is a great difference between various mechanical devices, and when speaking of these would it not be as well to state which are the most satisfactory?

Mr. Ruffieux, *Special Reporter*. — One would obviously choose the most suitable.

The President. — Have you any proposal to make, Mr. Ferreira?

Mr. Ferreira (in French). — No, I

only wished to draw attention to this point.

**The President.** — I am not sure that « technical processes » is quite the phrase that we should use in the ordinary way. I should have thought that the word « method » might be used.

**Mr. Ruffieux** (in French). — The word « method » has a wider meaning. This clause is due to Mr. Deyl and in the opinion of this gentleman it is a question of reviewing the different processes of carrying out the work.

**The President.** — Under these conditions we will retain the words « technical processes ». (*Agreed.*)

— Clause 6 was adopted.

« 7. It is essential, for economic reasons, to prolong as far as possible the life of the material used in the permanent way, and in particular not to scrap sleepers before they have reached their limit of wear. »

**Mr. Tettelin** (in French). — I would like permission to draw the attention of the section to a subject which has not received a great deal of attention and which is, however, of great importance, namely, the ballast, which is dealt with in some of the reports, especially in that of Mr. Ruffieux. In this report it is stated that the ballast should be cleaned every 3 to 7 years; this is a costly operation, and I might say an unproductive one from the point of view of the solidity of the track, for the operation of removing the ballast does not lead to a solid track. The report also mentions cutting the grass which grows on the line by means of a special rail car.

Grass is a very serious trouble and this should be mentioned in our final summary.

We have noticed during our visit to England that there is not a single blade of grass on the lines, and it is to be concluded that in this country some solution has been found other than cutting the grass. It is obvious that where there are means of preventing the grass from growing one will no longer be concerned with methods of cutting it.

The operation of cutting grass is not without difficulties, because it requires the use of apparatus which do not always work satisfactorily in practice.

It appears necessary therefore to say that it is important to keep the ballast in a clean condition and to prevent grass from growing so as to avoid the necessity of cutting it. It must be remembered that it is not only the grass which must be removed, but also the humus which is deposited on the ballast from the decay of the cut grass.

**Mr. Ruffieux** (in French). — One might mention the ballast in the first place and say that it is essential to keep this in perfect condition.

**Mr. Tettelin** (in French). — We should not hesitate to use the word « grass » in our summary. « In a perfect condition » does not imply much. Grass is a very great inconvenience which has been overcome in England, and it is important, that the summary should draw attention to this point.

**Mr. Ruffieux** (in French). — Let us say « It is essential in order to economise in maintenance work to keep the ballast in a perfectly clean condition and free from all vegetation ».

**The President.** — Personally I agree entirely with Mr. Tettelin but there is another point about ballast which seems to me to be even more important than the weeds, and that is keeping it clear,



clean and free from the subsoil working up through it from below, and from the ashes falling upon it from the engines passing above. If the ballast becomes dirty from either one of those causes or the other, it is impossible to maintain a satisfactory road.

**Mr. Tettelin** (in French). — I am sorry that the word « grass » does not appear in the text. As I have just said, in England this difficulty has been overcome, and this point should be mentioned.

**Mr. Ruffieux** (in French). — The following is the text which I propose : « It is essential, for economic reasons, to keep the ballast in a perfect state of cleanliness and free from all vegetation, and also to prolong as far as possible the life of the materials used in the permanent way, and in particular not to scrap sleepers before they have reached their limit of wear. »

— This text was adopted.

**The President.** — That will do, and we can get that into English later on.

« 8. The obstacles encountered in Europe as regards the development of mechanical processes in routine maintenance work are generally of an economic nature : high cost of the mechanical equipment, inadequate daily output of the equipment resulting from the difficulty of co-ordinating mechanical work and manual labour on a given piece of work. These obstacles, however, are not met with in America, where considerable economies are effected by the use of not only small appliances such as tamping machines, but also of much more powerful machines, such as machines for screening ballast, levelling the track, etc. »

No mention is made in this paragraph

of what seems to me to be one of the greatest difficulties in using mechanical appliances, and that is that on lines where there is a frequent service of trains, it is not possible to give occupation of the line and in that case it is difficult to use machines which cannot be easily and quickly removed from the line. That is not mentioned, but it is a difficulty which we find in this country.

Would anyone like to speak upon this paragraph.

— No one wished to speak and clause 8 was adopted.

« 9. Motor trolleys (provided due regard is paid to the regulations relating to the safety of running on the line) constitute an economic means of transporting men and materials. »

I would like some of the English delegates to say a word upon this, because if this is a fact, we want to know why they do not use them.

**Mr. Coomber, Reporter.** — I think as far as British railways are concerned the use of motor trolleys is very rare. In fact, if I remember rightly, they are only used on one railway. Generally speaking the traffic on British lines is too heavy to admit of motor trolleys being used for the conveyance of men to and from their work.

**Mr. Jullien** (in French). — Even on important lines we use motor trolleys and obtain excellent results.

Provided that we conform with the rules of the traffic department, we are free to use our motor trolleys as required. I think I may say that the motor trolleys are an economic means of transporting men, and more particularly for material. As regards the cost, it is certain that the

first cost of a motor trolley may be saved in two years as a result of the economy effected in transporting material. I am therefore strongly of the opinion that the words « and particularly for the transport of materials » should be inserted.

**The President.** — In order to meet the difficulty mentioned by Mr. Coomber, we might begin by saying « Where traffic conditions allow of it », and then continue « motor trolleys »; etc.

**Mr. Ruffieux** (in French). — Shall we say « on lines where the traffic allows ». (*No! No!*)

**Mr. Tettelin** (in French). — Traffic conditions always allow a motor trolley to run between the trains. A motor trolley does not moreover run every day. Further a motor trolley is no worse than a train, as it also runs under the protection of the signals.

**Mr. Toller**, Burma Railways, British India. — Who is going to use the trolleys?

**The President.** — I take it the platelayers.

**Mr. Toller.** — Then it is not applicable to India.

**Mr. Depoorter**, *Secretary* (in French), asked for some more definite information on this point.

**The President.** — Mr. Toller's point is that the ordinary platelayer in India could not use these trolleys.

**Mr. Depoorter.** — Why not?

**The President.** — Because he has not got sufficient knowledge or education, and he cannot read signals.

**Mr. Lines.** — The trouble about using

mechanical appliances in India is that the Indian has absolutely no mechanical instinct of any kind. It takes him years to learn how to use a crowbar. We have machines in use, but we have to pay a skilled mechanic, and he usually puts the machine out of order, so that it has to go into the shops at the end of a month.

**Mr. Ray**, *Reporter*. — In the United States the motor car is used very extensively for transporting trackmen and bridgemen to outlying places, especially on lines where traffic is light. They are not in use, where the traffic is very dense, as in many places it would not be safe to use them. Take the case of the line which I represent (The Delaware, Lackawanna & Western Railroad) where we handle from 1 000 to 1 500 freight cars daily, and 12 to 16 passenger trains per day, the cars are used regularly by all trackmen. The foremen in charge of the section gangs are all qualified to operate their cars before they are permitted to use them. They are not appointed foremen until they understand all train movements, and know the time cards. Naturally a man is not supposed to put a motor car on the track until he first finds out how the trains are running by getting in touch with the dispatcher either through a station agent or by a phone. He must protect himself. His car is insulated, so that it does not operate the automatic signals; in other words, he is not protected by the automatic signals. We do have a good many cars struck, but the economy of using motor cars in getting the men to their work promptly and home quickly at night, thus permitting them to put in the full day on the job, is sufficient to overcome the disadvantages of possible accidents.

As far as the handling of material is



concerned, there is not very much material handled by motor cars, as it is not safe to do so on lines where the traffic is heavy. On the lighter traffic lines — branch lines — material is handled to a very great extent by those motor cars.

**Mr. Ruffieux** (in French). — The reservation which I have introduced into the clause and which is translated « à condition qu'on se conforme au règlement relatif à la sécurité », is due to Mr. Ray. This clause is of special interest to America.

**The President.** — That, I think, is quite a clear explanation; but I am not sure that we should have read into that paragraph that the motor car is not run as a train, and that it finds its own way and looks after itself. I take it that on the Continent the motor car running on the track is signalled as a train, and the wheels are not insulated, and therefore work the automatic signals.

**Mr. Quinquet** (in French). — On the Paris-Lyons-Mediterranean, draisines are run under the protection of the station signals in the following way.

The driver of the draisine is provided with a telephone by means of which he can communicate with the neighbouring stations by connecting the telephone to the telegraph wire between these stations.

Before leaving a station, the driver of a draisine obtains permission from the station-master to occupy the line. If the line is clear, he departs under the protection of the station signals.

On arrival at this destination, the draisine is lifted off the rails, and the driver then gets into communication with the stations on either side and informs them that the line is clear.

When he wishes to use the draisine to

proceed to another place, he again gets into communication with the two stations and asks permission to occupy the line.

These draisines perform very satisfactory services for transporting material. The transport of staff is not always easy on certain lines. The draisine would have for this purpose to leave in the morning and pick up the platelayers at the various level crossings so as to arrive at a proper time at the place where work is being carried out.

In the same way, in the evening it would have to leave the place of work at the end of working hours in order to convey the men home. However, in the morning and the evening, at the times when it would require to be run, on many lines there are a number of regular trains, and it is therefore impossible to convey the staff in this manner.

**The President.** — Gentlemen, we have got paragraph 9 before us and it seems to me that the paragraph as it stands is quite innocuous. No doubt in many conditions the use of motor trolleys is economical, and that is really all that it says; so that if you see no further objection we will pass No. 9.

**Mr. Ruffieux** (in French). — It is to be understood then that we add the words « particularly for the conveyance of material ». (*General agreement.*)

**The President.** — « 10. The grouping of maintenance personnel into gangs for work on long stretches of line, and the provision of rapid means of transporting the gangs (trains or trolleys), generally gives satisfactory results. »

That is a review of the practice which has obtained recently in many countries. We have no experience, or very little

experience, of it in this country, and therefore I do not think the engineers of this country can speak with authority upon it, but where it has been tried we understand that the results have been satisfactory.

**Mr. Ruffieux** (in French). — This clause is referred to in Mr. Coomber's report.

**Mr. Coomber.** — It has been tried on only two railways in this country, and it has not been in operation very long; but so far as that experience goes it has been satisfactory.

On the other hand, one railway in South Africa has tried the same method, and has given it up, because in their view it was not satisfactory. As far as I and my report are concerned, that is the only experience there is with regard to the grouping of maintenance personnel into gangs.

**The President.** — Would it meet with your views, gentlemen, if in the last two lines instead of saying « generally gives satisfactory results », we said « this system has in some cases produced satisfactory results »? If there is no objection to that, we will make that alteration.

— Clause 10. thus amended was adopted.

« 11. The ordinary routine forms of maintenance work do not lend themselves to the contract system, and should be carried out by the permanent personnel of the railway, augmented where necessary by temporary employees.

« For the more important work, the same system is still to be preferred, but there is no real objection (and indeed in certain cases it may be desirable, either for economic reasons or because of the

scarcity of labour) to have the work performed by contract provided contracts are placed on the results of competitive tendering. »

**Mr. Coomber.** — I do not like the statement in the second paragraph of clause 11, which says : « There is no real objection (and indeed in certain cases it may be desirable...) to having the work performed by contract ». The same question was discussed at the Rome Congress, and I stated there my experience of work done by contract at that time; because the railway company which I then represented, and one other railway, were the only companies in the whole of Great Britain which did this work by contract. At the time of the Rome Congress my company had already given it up, and were doing the work themselves, and they found it much more satisfactory and efficient. I do not think contract work is at all satisfactory in the British Isles.

**Mr. Ruffieux** (in French). — That is why we say later « in certain cases » to cover the case of countries which do not approve of the contract system.

**Mr. Jullien** (in French). — In France we are frequently obliged to adopt the contract system.

**Mr. Quinquet** (in French). — In a number of cases we cannot do otherwise.

**Mr. Coomber.** — Of course my remarks apply only to Great Britain. I understand that other countries find the contract system satisfactory, but in this country we do not.

**The President.** — We are in a little difficulty over this paragraph. In certain countries the feeling amongst engineers is very strong that re-laying and



maintenance work by contract is to be avoided at all costs; in other countries it is the usual method, and has been found quite satisfactory so that it is a little difficult to draw up a clause which will be satisfactory to all parties.

**Mr. Ruffieux** (in French). — We might say « But in certain countries it is considered that there is no real objection ».

**The President.** — **Mr. Ruffieux** proposes to insert the words « in certain countries ». Does anyone object to this? (*After a pause*) : Very well, we will alter the clause in that way.

« 12. As the foremen's rounds of inspection are essential for the efficient control of maintenance work, they should be not only increased, but facilitated by the provision of adequate means for the rapid transport of such employees during the execution of their duties.

« Recording apparatus of the *Hallade* type constitutes a valuable auxiliary means of controlling maintenance work. »

**Mr. Quinquet** (in French). — This wording proposes to increase the rounds of inspection by providing the staff with rapid and convenient means of transport. I think that it is advisable for these inspectors to continue to closely observe the details of the track which they will not be able to do when on rapid moving vehicles. I think therefore that one should insert the words « provided that these inspectors also make the necessary rounds of inspection on foot ».

**Mr. Coomber.** — I am not quite clear as to the meaning of this, and the reason of my difficulty is the use of the word « foremen ». As it stands, to my mind

this paragraph is contrary to No. 3 of the final summary. No. 3 says : « It is desirable to reduce as far as possible the time spent in periodical rounds of inspection », and No. 12 which we are now considering says : « As the foremen's rounds of inspection are essential for the efficient control of maintenance work, they should be not only increased but facilitated », and so on.

**The President.** — I think that is a mis-translation. I think « foremen » there should be « inspectors ».

**Mr. Coomber.** — If it means « inspectors », in this country the inspector walks his length; he is not taken about in a motor or by any other means of transport. It is his duty to walk his length day by day, and to take a section each day.

**The President.** — That is a point which has been brought forward by other delegates, and I think it certainly ought to be put in.

**Mr. Quinquet** (in French). — The same applies in our country. The clause should say « Inspector's rounds... ».

**Mr. Depoorter, Secretary** (in French). — It would be better to use the word « inspector ».

**The President.** — Very well. There is one other word which I do not quite like. It reads at present : « As the inspector's rounds of inspection are essential for the efficient control of maintenance work, they should be not only increased » — there may be quite enough of them already. Why increase them?

**Mr. Dreyfuss** (in French). — We might say « their frequency might be facilitated ».

**The President.** — I think it would be better to use the word « frequency » and to complete the clause as suggested by Mr. Quinquet.

**Mr. Ruffieux (in French).** — The text will therefore read as follows : « As the inspector's rounds are essential for the efficient control of maintenance work, their frequency should be facilitated by the provision of adequate means of rapid transport, provided that the rounds on foot, which are of the greatest importance are also carried out. Recording apparatus of the Hallade type constitutes a valuable auxiliary means of controlling maintenance work. »

**The President.** — You have heard the suggested French text. Has anybody any objection to make to that? (*No! No!*) I think while the interpreters are getting out the English text, we might go on to No. 13, and we will read No. 12 when it is ready.

« 13. — The analysis of the various operations comprised in maintenance work, and the rational application of such analysis to the organisation of the work, is a problem which calls for considerable further study. This question is intimately connected with the further question of the control of output, of bonuses and of piece work. It does not appear that the investigations so far carried out in this direction have resulted in any general solution of the problem. »

Does anyone desire to speak upon that?

**Mr. Deyl, Reporter (in French).** — Seeing that the majority of administrations do not seem to have any hopes in the future of reducing the pay of the maintenance personnel, it is important to take steps with a view of obtaining an

increased output by a more economical organisation of the work.

**The President.** — Then clause 13 passes. Before we go any further, can we have the English text of No. 12 from the interpreters?

An interpreter read an English translation of the French text proposed by Mr. Ruffieux.

**The President.** — I think I should say, « in addition to the rounds on foot, which are essential ».

« 14. The use of powerful mechanical appliances, such as those in use in certain parts of the British Empire and in America, may be expected to transform the technical aspect of the problem of renewals of the superstructure of the permanent way.

« As regards the older processes, in which mechanical appliances play but a small part, it is desirable to determine by systematic research which are the best methods from the economic and technical points of view.

« This class of work may be carried out either by the railways themselves or by contract, with equally satisfactory results; choice between the two systems is determined by the circumstances of each particular case, or by the conditions peculiar to the individual railway. »

**Mr. Ferreira (in French).** — For the third time the use of mechanical appliances has been mentioned, and each time I have pointed out that not sufficient information has been given as regards the type of the apparatus and their output.

In addition to this question, there is another very important point put forward by the delegate from the Czecho-Slovakian Railways, which is the question of the



scientific organisation of the work which is already recognised as being important and which will become still more important in the future in view of the ever increasing scarcity of labour.

For these reasons, I propose that the question of the use of mechanical appliances for repairing and relaying the track should appear on the agenda for the next Congress, and also the question of the adoption of scientific methods of organising this work. (*Applause.*)

Mr. Miles, Great Central & Midland Joint Committee, Great Britain. — Since I came into this room, Mr. President, you have asked me to describe a track-laying apparatus which is in use in these islands. It has been designed by Mr. Bretland of the Great Southern Railway of Ireland to overcome his labour difficulties. I may say that it is designed for a 5-ft. 3-in. gauge, flat bottom rail section.

The whole of the permanent way material is assembled at the depot, where there is an overhead runway and an electric crane.

The new permanent way is put together complete in rail lengths, the sleepers being attached to the rails, and then loaded up on to wagons and taken to the section of line which is to be renewed.

The track-laying apparatus picks up the old permanent way, *i. e.*, the rails with the sleepers attached, loads it up in the wagons, and relays a new rail length, all this being done section by section, an old length of rail being pulled up and a new length laid in its place. The train load of old material is then taken to the depot where it is broken up and the various materials selected for further use or scrapped.

The train consists of a locomotive, a machine van with an electric generator

for supplying the current, the locomotive providing the steam for this, and there are about seven or eight wagons for holding the permanent way with a traverser which runs the whole length of the train and an electrically worked cradle, the sides of the wagons acting as the rails. There are also a cantilever wagon with a cradle which can either pick up the old rails and place them in the wagons or place the new ones in position, and a further wagon with a winch for dragging each length of rail into its position just a few feet. Then there is the guard's or brake van in which the men working the apparatus accompany the train.

I have described the vehicles in the order in which they are placed in the train, and the arrangement is that the whole train is taken on to the section which has to be renewed where the winch van and the guard's or brake van are uncoupled from the rest of the train.

The first procedure is to get entire possession of the line. The cradle on the cantilever picks up one length of rails or two if they are in short lengths, dropping them down in the wagon behind.

The apparatus which I have seen picks up a length of rail of 46 feet.

The traverser and cradle then come along and run the length of old road taken up right back on to the wagon at the rear end of the train, and conveys a length of new road to the cantilever with its cradle, dropping this into position. The train then moves on a rail length, and the same procedure is repeated length after length.

The crew working the train and the relaying operations consists of the driver and fireman of the locomotive, the man who looks after the engine and generator

in the van, two men who work the conveyors or cradles, and about 20 to 25 other men, which latter attend to the relaying of the road and packing it up when it is once in position. In about four hours about 600 yards of road can be picked up complete and relaid in the manner described. The work is carried out principally at night time, the train being lighted up. It does not foul the adjoining road where two roads exist.

After a section of line has been dealt with the arrangement is that the cantilever wagon and the wagon in which the power is generated are left behind whilst the engine proceeds to take the old material back to the depot where it is unloaded and broken up, and the wagons re-loaded with new material to relay a further length of line.

The whole apparatus, Mr. Bretland states, has been most successful. He has been able to reduce his labour and engine power charges by somewhere about 50 %.

The question is now being considered as to whether the same apparatus could be used for bull-headed rails with chairs and I think perhaps we may be able to arrange to do so, and to save considerably in our labour charges.

Of course it is essential to get entire possession of the road for some hours, say three or four, to enable a sufficient amount of work to be done by the track-layer.

**The President.** — We are much obliged.

**Mr. Coomber.** — I think the phrase in the last paragraph, « With equally satisfactory results », should be omitted. In this country we do not agree that the results would be equally satisfactory if the work were carried out by contract.

**The President.** — That is the same point as was raised before, as to whether contract work is as satisfactory as work carried out by the Railway Companies, upon which there is a very considerable difference of opinion.

**Mr. Lines.** — The clause could be made all right by deleting the words : « With equally satisfactory results ». It would read all right then, I think.

**The President.** — There is a very strong difference of opinion here. There are certain people here who say that the results are equally good, and certain people who say that they are not equally good. Therefore I think it is placing it too high for us to say that they are equally good.

**Mr. Dreyfuss (in French).** — We are speaking in general terms.

**Mr. Ruffieux (in French).** — The exact translation of the English text is as follows : « Work of this kind can be carried out either by the railways themselves or by contract with equally satisfactory results. »

The French text says : « Work of this kind carried out by the railway itself or by contract gives in either case satisfactory results. »

There is therefore a difference.

**The President.** — I think the English text might read like this : « This class of work has been carried out either by the railways themselves or by contract with satisfactory results. » It is quite clear that the English translation is not a correct translation of the French wording. Does anyone see any objection to that? (*After a pause*) : Then that will pass.

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# DISCUSSION AT THE GENERAL MEETING

Meeting held on the 27 June 1925 (morning).

PRESIDENT : THE RIGHT HON. VISCOUNT CHURCHILL.

GENERAL SECRETARIES : SIR HENRY FOWLER and Mr. P. GHILAIN.

Sir Henry Fowler, *General Secretary*, read the final summary adopted by the 1st section.

— This final summary gave rise to no comments.

The President. — The final summary is therefore as follows :

## Final summary.

« 1. — The proper construction and drainage of the formation and super-structure is a *sine qua non* of efficient maintenance work.

« 2. — The standardisation of material is desirable for both technical and economic reasons.

« 3. — It is desirable to reduce as far as possible the time spent in periodical rounds of inspection.

« 4. — It is desirable, either on the knowledge gained by past experience, or by adopting some method of suitably distributing the various elements of maintenance work, to determine the proportion which should exist between labour employed and work done.

« 5. — Although the system of carrying out local maintenance work where found necessary is adopted on many railways, the majority of the reporters consider that the system of a periodical general overhauling is the safer and

« more economical. The two systems are perhaps not so different from one another as might be supposed, both being based on the same principles, although in one case these principles are applied according to the necessities of the moment, while in the other they receive a more systematic application. In any case, both systems give excellent results in the hands of companies who know how to work them.

« 6. — The technical processes adopted in the different branches of maintenance work are not uniform. It would be useful if systematic experimental work could be undertaken with a view to determining the best methods of work applicable to each operation, taking into account the advantages to be derived from the use of mechanical appliances.

« 7. — It is essential for economic reasons to keep the ballast clean and free from vegetation; also to prolong as far as possible the life of the permanent-way materials; in particular, sleepers should not be scrapped before reaching their limit of wear.

« 8. — The obstacles encountered in Europe as regards the development of mechanical processes in routine maintenance work are generally of an economic nature : high cost of the mechanical equipment, inadequate daily output of

« the equipment resulting from the diffi-  
« culty of co-ordinating mechanical work  
« and manual labour on a given piece of  
« work. These obstacles, however, are  
« not met with in America, where con-  
« siderable economies are effected by the  
« use of not only small appliances such  
« as tamping machines, but also of much  
« more powerful machines, such as ma-  
« chines for screening ballast, levelling  
« the track, etc.

« 9. — Motor draisines (provided due  
« regard is paid to the regulations relat-  
« ing to the safety of running on the line)  
« constitute an economic means of trans-  
« porting men and materials.

« 10. — The grouping of maintenance  
« personnel into gangs for work on long  
« stretches of line, and the provision of  
« rapid means of transporting the gangs  
« (trains or trolleys), has in some cases  
« given satisfactory results.

« 11. — The ordinary routine forms  
« of maintenance work do not lend them-  
« selves to the contract system, and should  
« be carried out by the permanent per-  
« sonnel of the railway, augmented where  
« necessary by temporary employees.

« For the more important work, the  
« same system is still to be preferred, but  
« (in certain countries there is no real  
« objection and indeed in some cases it  
« may be advantageous) either on account  
« of economic reasons or because of the  
« scarcity of labour it may be necessary  
« to have the work performed by contract,  
« provided that contracts are placed on  
« the result of competitive tendering.

« 12. — As the Inspectors' rounds are  
« essential for the efficient control of  
« maintenance work, their frequency  
« should be facilitated by the provision

« of adequate means of rapid transport,  
« in addition to the rounds on foot,  
« which are of the greatest importance.  
« Recording apparatus of the Hallade  
« type constitutes a valuable auxiliary  
« means of controlling maintenance work.

« 13. — The analysis of the various  
« operations comprised in maintenance  
« work, and the rational application of  
« such analysis to the organisation of the  
« work, is a problem which calls for con-  
« siderable further study. This question  
« is intimately connected with the further  
« question of the control of output, of  
« bonuses, and of piece work. It does  
« not appear that the investigations so far  
« carried out in this direction have re-  
« sulted in any general solution of the  
« problem.

« 14. — The use of powerful mechan-  
« ical appliances, such as those in use in  
« certain parts of the British Empire and  
« in America, may be expected to trans-  
« form the technical aspect of the pro-  
« blem of renewals of the superstructure  
« of the permanent way.

« As regards the older processes, in  
« which mechanical appliances play but  
« a small part, it is desirable to determine  
« by systematic research which are the  
« best methods from the economic and  
« technical points of view.

« This class of work has been carried  
« out either by the railways themselves or  
« by contract, with satisfactory results;  
« choice between the two systems is de-  
« termined by the circumstances of each  
« particular case, or by the conditions  
« peculiar to the individual railway. »

— This final summary was ratified by  
the General Meeting.



### LEVEL CROSSINGS (PUBLIC ROADS).

*Dispensing with crossing keepers. Visibility of the trains from the crossing : warning notices and signals, etc.*

#### Preliminary documents.

1st report (all countries, except the British Empire, America, France, Italy, Spain and Portugal), by Mr. MAAS-GEESTERANUS. (See English edition of the *Bulletin*, February 1925, p. 203, or separate issue [with red cover] No. 16.)

(See English edition of the *Bulletin*, January 1925, p. 13, or separate issue [with red cover] No. 11.)

4th report (Italy, Spain and Portugal), by Mr. MENDIZABAL. (See English edition of the *Bulletin*, May 1925 [2nd part], p. 1621, or separate issue [with red cover] No. 41.)

2nd report (France), by Mr. R. RUFFIEUX. (See English edition of the *Bulletin*, March 1925, p. 761, or separate issue [with red cover] No. 27.)

Special reporter : Mr. R. RUFFIEUX. (See English edition of the *Bulletin*, June 1925, p. 2073.)

3rd report (America), by Mr. G. J. RAY.

## DISCUSSION BY THE SECTION

Meeting held on 25 June 1925 (morning).

Mr. E. F. C. TRENCH, C. B. E., IN THE CHAIR.

The President. — No doubt you will have read the very interesting reports on the subject of level crossings, and as we have only 20 minutes to discuss the special report, I think it would be well to pass at once to the final summary.

Mr. Ruffieux read his special report, published in the *International Railway Congress Bulletin* for June 1925, p. 2073.

Mr. Maas-Geesteranus, *Reporter*. — The Japanese railways could not send their answer in time, on account of the earthquake having destroyed their records, I have just received the information from them a fortnight ago, so that this could not be used for our report.

The principal features of the report are that they have on 11 840 km. (7 350 miles)

of line, about 64 000 level crossings, of which about 62 000 are without gates and without keepers, and 2 000 with gates and keepers. They have been without keepers since the lines were put into service. When once established for certain crossings, they are very rarely given up.

When constructing new railways, the condition of the traffic is the factor in deciding whether a level crossing shall be provided or not. The discontinuance of the keeper's services is decided after investigating on the spot whether there is a great decrease in the number of persons passing over, or when an open view has been obtained by improvement works in highways or railway lines, then there is no regulation with regard to the procedure.

**The President.** — I think we had better proceed at once to the final summary, and endeavour to get through before 1 o'clock. This is a subject, as you know, which perhaps concerns us less in this country than it concerns the administrations in other countries. The numbers of level crossings here are few, and we are very greatly restricted by the laws of England and the regulations of the Ministry of Transport, so that even if we desired to dispense with gatekeepers and gates we should have very great difficulty in doing it in the present state of the law.

The first paragraph is :

« 1. The abolition of gate keeping gives important economical advantages, and causes no inconvenience to crossings on roads where the traffic is not too great, and where the field of view of approaching trains from the road is sufficient in all directions. »

I think perhaps the English text would

be clearer if instead of « gate keeping » we said « gate keepers ».

**Mr. Tettelin, Northern Railway, France (in French).** — I should like to make a preliminary remark.

In the various clauses of the final summary, the question of the abolition of gatekeepers is discussed, but there is no mention of the ideal method, which would be to abolish the level crossings themselves. I think that this point should certainly be mentioned. It is obvious that the best means of abolishing gate keepers and all the risks incurred, is to abolish the level crossing, and we can hardly do less than state this fact seeing that we have cases of railways which have been built without any level crossings. We should therefore say in the first clause that the best method of abolishing gate keepers is to abolish the level crossings as far as circumstances permit.

**The President.** — That of course is absolutely true, but I do not think it quite comes within the terms of reference.

They pre-suppose that the level crossing is there.

**Mr. Ruffieux (in French).** — The omission of the question of the abolition of level crossings is intentional.

**Mr. Tettelin (in French).** — I only wished to raise the question.

**Mr. Quinquet, Paris-Lyons-Mediterranean Railway (in French).** — The first clause as now worded appears to refer to roads carrying only a moderate traffic. It appears to me that it would be better to add : « except where the traffic is heavy ».

**Mr. Ruffieux (in French).** — We could merely say : « It gives rise to no



inconvenience where the visibility of trains approaching the level crossing is sufficient ».

**Mr. Quinquet** (in French). — I have made this observation so that in France one could not say that the Congress had expressed the opinion that the abolition of gate keepers is only admissible on roads carrying a light traffic.

**Mr. Ruffieux** (in French). — That is the reason why I propose to delete the words : « where the traffic is not too great ».

**The President.** — Then if you agree, the wording would be : « The abolition of gate keepers gives important economical advantages, and causes no inconvenience to crossings on roads where the field of view of approaching trains from the road is sufficient in all directions ». It does not say anything about the traffic on the railway or on the road.

**Mr. Hicks**, Burma Railways, British India. — I think it is an essential point that if the traffic is heavy you must have a gate keeper. You cannot do without him.

**The President.** — Gentlemen, what is your view? It has been suggested that the important factor is the traffic on the roads, and that if the traffic on the road is intense it is necessary to have a gate keeper.

**Mr. Coomber**, London Midland & Scottish Railway. — Clause 10 of the final summary seems to suggest that the traffic on the road is not the important factor, because it is suggested that a resolution should be passed to allow gate keepers to be done away with, « without considering the importance of the crossing ».

**Mr. Quinquet** (in French). — This clause is contradictory to clause 1.

**Mr. Maas-Geesteranus.** — The density of the traffic on the road is very important, not the density of the traffic on the railway.

**Mr. Ruffieux** (in French). — It would appear that, according to the American reporter, safety is provided for, however heavy the traffic on the railway, if the visibility of approaching trains, as seen from the level crossing, is sufficient and if warning signals are erected to give notice to road users of the approach of a level crossing.

**The President.** — Can you help us upon this point, Mr. Ray?

**Mr. Ray, Reporter.** — In the United States the main point is the traffic on the highway; the question of the number of trains has little or nothing to do with the situation. If the traffic on the highway is great, we are generally required to put a watchman or flagman on the crossing. As a matter of fact, the worst accidents that we have happen on the minor branch lines of unimportant railways where people have little regard for the traffic on the line. They know that there are but few trains, disregard them, and run across the crossings at high rates of speed. Then we have lines where the railways run parallel with the highway for a considerable distance and then cross the road. Motorists approaching the crossing will attempt to race the train, and very often they are struck, due to the fact that they pay no attention whatever to the train, knowing that there are very few trains on the line. Thus we have found it very necessary to put crossing watchman on the important highways, re-

ardless of visibility. The rate of speed that motors make on the highways in the States is almost as much as the rate of speed of trains. It is nothing for them to run at 40 miles an hour, although they are supposed to be restricted to 30 miles, and the visibility of approaching motor from the railroad is of little concern. The only thing that the engine driver can do is to carry out his duties, blow his whistle, and ring his bell. He cannot tell how fast a motor is coming on the road, so that it is all up to the man on the highway. If he is a reckless fellow he is liable to get hit; so that where there are busy roads, we generally have to provide watchman. After they are once on we are never able to get them off; this cannot be done in the States.

Mr. Maas-Geesteranus (in French). — I quite agree with Mr. Ray. It is obvious that generally speaking the traffic on the railway is never so intense that one cannot cross the railway between two trains, but nevertheless it may happen that on certain roads there is such a dense traffic that it would be difficult or almost impossible for trains to pass. It is therefore obvious that the traffic on the road is much more important than the traffic on the railway.

Mr. Wasiutynski, Polish State Railways (in French). — I see that no mention is made of visibility of the level crossing from the point of view of the engineman. The engineman should be able to see that the level crossing is clear, as this would obviate accidents.

The President. — I am afraid that that is hardly a duty which we could put upon the engineman of an express train — that he should pull up if he saw an encumbrance on the level crossing.

Mr. Maas-Geesteranus. — I think that it is quite impossible for a locomotive driver to stop when he sees that there is a car nearing the crossing, because he never can tell whether the car will stop or not. Then an automobile will try to pass before the train, and the driver never can tell whether he will touch the car or not.

Mr. Wasiutynski (in French). — I am strongly of the opinion that from a safety point of view, the driver should be able to see whether he may pass over a level crossing. It may happen that a motor car or other vehicle may be overturned on the railway, and if the driver sees this sufficiently early, he can avoid an accident, which may be very serious, not only for the road vehicle, but also for the train.

Mr. Tettelin (in French). — One cannot saddle the engine driver with the responsibility of avoiding accidents at level crossings.

While admitting that the driver might see, to take the example cited by Mr. Wasiutynski — a vehicle overturned on the line — he would never see it in sufficient time to stop his train.

The President. — Gentlemen, we must come to a conclusion upon this point. The question is whether we shall leave in the words, « where the traffic is not too great ». There seems to be a considerable body of opinion which thinks that on roads with very heavy traffic it is undesirable to do away with gates and gate keepers.

Mr. Quinquet (in French). — It appears to me that if the visibility from the road users point of view is good, it must be also good from the engine driver's point of view.



**Mr. Tettelin** (in French). — For my part I think it would be preferable to insert the words « except where the traffic on the road is very heavy ».

**Mr. Quinquet** (in French). — Certainly. If we say : « roads carrying exceptionally heavy traffic ».

**Mr. Jullien**, Paris-Orleans Railway (in French). — In any case it will be necessary to say : « when the visibility of trains approaching the crossing is sufficient when seen from the road in all directions » and one might add : « except in the case of roads carrying very heavy traffic ».

**Mr. Ruffieux** (in French). — Shall we say : « and causes no inconvenience, except on roads carrying very heavy traffic when the visibility, etc. ». (*Agreed.*)

The final wording is therefore as follows :

« 1. — The abolition of gate keepers gives important economical advantages, and causes no inconvenience to crossings on roads, except where traffic is exceptionally heavy, provided that the field of view of approaching trains from the road is sufficient in all directions. »

— Carried.

**The President.** — « 2. — The approach to level crossings, the supervision of which has been abolished, should be notified to users of the road by signals that are visible day and night where necessary, and which allow drivers of the fastest running vehicles likely to use the crossings, to stop before reaching them. In cases where the field of view is insufficient, these signals should themselves be preceded by advanced signals placed at suitable distances from them. It is advisable that these signals should indicate the number of

tracks that have to be crossed. The international signal announcing the approach to a level crossing is not suitable for unattended crossings. »

**Mr. Deyl**, Czecho-Slovakian State Railways (in French). — It would appear that the level crossings which have never been guarded need not be provided with special warning signals. However, I should like to have inserted at the beginning of clause 2 the following paragraph :

« In general, warning signals may be used to replace gate keepers at level crossings. These signals should be provided on roads where gate keepers and gates have been abolished. »

This appears necessary to me, because it would infer that where gate keepers and gates have not been abolished, these warning signals would not be necessary.

**Mr. Ruffieux** (in French). — I have dealt with the origin of this question in the main portion of my report, but it does not appear to me to be advisable to insert this in the final summary.

**Mr. Tettelin** (in French). — It is obvious that on level crossings which are not at present guarded there is no need to consider the abolition of gate keepers, such level crossings do not therefore come within the category dealt with in clause 2.

**Mr. Maison**, Ministry of Public Works, France (in French). — We have, in France, for some years, abolished the barriers at a number of level crossings which were formerly guarded, and have placed warning signals on the road.

Experience has shown that this answers very well. However, we have received a number of complaints asking that the gates should be replaced.

— Clause 2 was carried.

**The President.** — « 3. Even in those cases where the visibility of trains as seen from the road is insufficient, abolition of gate keepers may take place without inconvenience, on condition that automatic apparatus announcing the approach of trains is placed near the crossings. »

— Carried.

« 4. Level crossings at which gate keeping is dispensed with during part of the day should be provided with special warning apparatus similar to that used on unattended crossings, but hidden from the public view during the period the crossings are under supervision. »

— Carried.

« 5. A good automatic warning signal working at all hours of the day and night offers a much greater guarantee of safety at nearly all level crossings than the protection given by gate keepers or attendants during a part of the day only. »

— Carried.

Paragraph 6 is : « Automatic apparatus announcing the approach of trains, having two scintillating lights placed on each side of a central supporting post, and fitted with oscillating signals that can be depended upon, is the best form of automatic signal. »

**Mr. Ruffieux, *Special Reporter*** (in French). — I would like to mention that this clause is due to Mr. Ray.

**Mr. Tettelin** (in French). — Is it necessary to use the word « best »?

**Mr. Jullien** (in French). — One might say : « appear to be the best ». Moreover, I do not see that it is necessary to state the number of lights.

**Mr. Ruffieux** (in French). — It

would be sufficient to say : « consisting of scintillating lights ».

**The President.** — This description of the signals, Mr. Ray, is drawn from your report. You see no objection to it?

**Mr. Ray.** — No, it is all right.

**The President.** — I am not very clear what « two scintillating lights » are, and what « oscillating signals » are. Do you have both sorts on each level crossing?

**Mr. Ray.** — We have two distinct kinds of automatic signals in America. One is a disc which hangs from a post and swings back and forth, with a red light in the centre, when a train is approaching. When the train passes the crossing, the disc is held up out of sight so that the signal indicates that the crossing is clear. The scintillating lights consist of two separate lights fastened at the end of a cross-arm like *this*- (illustrating), and they flash alternately.

**The President.** — These are the scintillating lights to which you refer?

**Mr. Ray.** — Yes, and they are usually considered to be the best signal. They are, generally speaking, more visible, and they are also cheaper to maintain and a somewhat more reliable.

**Mr. Ruffieux** (in French). — The following is the text which I propose :

« Automatic signals giving warning of the approach of trains consisting of scintillating lights or oscillating signals, which work in a reliable manner, are among the best forms of automatic signals. »

**The President.** — I am not sure that we have got it right now. As I understand from Mr. Ray, there are two forms



of signal lights at crossings : one consists of two scintillating lights, and the other consists of oscillating arms, but the English text reads that one and the other are used, — both of them.

Mr. Maas-Geesteranus. — No, it is one or the other.

The President. — Is that right, Mr. Ray?

Mr. Ray. — It is one or the other.

The President. — Then we want to correct the English text, because it is quite wrong. It will read : « Having either two scintillating lights or fitted with oscillating signals. »

— Clause 6 was carried.

« 7. — Automatic signals that announce the approach of trains should, if the apparatus fails or gets out of order, show to road vehicles a danger signal visible both day and night. It is desirable that they should not be influenced in the vicinity of stations by operations which do not concern the crossings. »

— Carried.

« 8. — Audible warning signals are not so serviceable as luminous signals, and are only justified at isolated crossings of small importance. »

— Carried.

« 9. — It is desirable that signals announcing level crossings and trains should be of standard type and international, so that their indications may be understood and observed by all. The general use of red lights in streets and as rear signals on automobiles should be prohibited. Such lights should only be used on roads at points where there is real danger, such as level crossings. »

Mr. Tettelin (in French). — I am of the opinion that we should delete the second paragraph. It is rather the affair of the railway administrations not to use red lights which may be confused with the rear lights of motor vehicles. We have no power to regulate the use of lights on motor vehicles.

Mr. Ruffieux (in French). — This clause is due to Mr. Ray.

The President. — Mr. Ruffieux says that he has taken this from your report, Mr. Ray, and if it is to be defended, it is for you to defend it.

Mr. Ray. — I would say this : that I should not attempt to defend it at any great length, for the reason that we have been unable to get it passed in our country since this report was written. There has been a very strenuous fight on in the States during the past year or two about the promiscuous use of red lights, and there is a movement on foot which will, I think, sooner or later eliminate the red tail light on automobiles. The great trouble that we have experienced with red lights on automobiles is from the statement of men who run their motor into crossing gates when the gates are down and trains are passing. We have had many crossing accidents due to motors running into trains passing crossings. The drivers nearly always contend that they thought they were running around a red light on a motor in front of them; they get up all manner of excuses. The thought was that if we could get rid of the red tail lights on automobiles, it would make a very great difference at crossings. Furthermore, in many cases roads run parallel with, or run close to, the tracks, and so enginemen are constantly coming on to and passing red lights, which is unsafe practice. We

often have cases of engine drivers mistaking red lights that are set up for other purposes as a tail light or « a flag » on the track; so that we have attempted to discourage the use of red lights in any place except at points where there is danger. I will say that the general public has refused to accept that point of view, and we have not yet gotten rid of the red tail lights on automobiles in the States.

Mr. Tettelin (in French). — At any rate we might express the opinion that road users should not use a rear light which may be confused with a railway light, for example, by modifying the form of light. I quite realise of course that we are not in a position to prohibit the use of any particular form of light in the streets or as a rear light on motor vehicles.

Mr. Jullien (in French). — If the red signal lights at a level crossing were made as a flash light or oscillating, it is obvious that it could not be confused with a red rear light of a motor vehicle.

The President. — I think the second paragraph of this clause is rather too sweeping. Would it suit everybody if we had words like these : « The indiscriminate use of red lights in streets should be discouraged? » Do you agree with that, Mr. Ray? It is very mild.

Mr. Deyl (in French). — The Czechoslovakian Administration, has submitted to the International Railway Union a proposal, with a view to arriving at a unification of the warning signals placed on roads at the approach to unguarded level crossings. The International Union, at a meeting held on the 22 May 1925, appointed a sub-committee to examine this question.

Mr. Ruffieux (in French). — I propose to say in the second paragraph : « The indiscriminate use of red lights in the streets should be discouraged ».

The President. — If no one objects to No. 9 in its altered form, we will pass it. The first paragraph of No. 9 stands unaltered, and the second paragraph in the English text will read : « The indiscriminate use of red lights in streets should be discouraged ».

Mr. Maas-Geesteranus (in French). — I think the second paragraph should be retained, but the word « prohibited » should be replaced by the word « limited ».

Mr. Ruffieux (in French). — If you put « limited », you are introducing regulations, and there are plenty of those already.

Mr. Jullien (in French). — I think it would be well to stipulate that the warning signals should differ from the red lights already used in the streets and the tail lights used on vehicles.

Mr. Tettelin (in French). — It is obviously unsatisfactory to use as a warning on a gate a light which may be confused with the rear light of a motor vehicle.

Mr. Jullien (in French). — I would repeat that scintillating and oscillating lights are quite different from those on motor vehicles.

Mr. Ruffieux (in French). — To conclude, do you not think it would be better to entirely delete the whole of the second paragraph? (*General agreement.*)

— No. 9 such amended is adopted.

The President. — « 10. The Congress



might adopt a motion inviting countries, the Railway Administrations of which are members of the International Association, to issue a recommendation that with rare exceptions, gate keeping at level crossings should be dispensed with when local circumstances — such as visibility — are favourable, without considering the importance of the crossing. »

Mr. Jullien (in French). — It would be a great advantage not to lay down any conditions, but to merely say : « when local circumstances permit » without mentioning visibility and without taking into account the importance of the level crossing.

Mr. Ray. — Cut out the words « without considering » and say : « taking into account » that will be all right.

The President. — Mr. Ray suggests that instead of saying : « without considering », we should say : « considering the importance of the crossing »; that is the opposite.

Mr. Ruffieux (in French). — The object we are trying to obtain here is the abolition of gate keepers, even at important level crossings, provided that the warning signals are sufficient.

Mr. Mendizabal, *Reporter* (in French). — I do not see that there is any objection to the abolition of gate keepers when local legislation allows this to be done.

Mr. Tettelin (in French). — Legislation will merely lay down the principles, and, moreover, it is not necessary in this summary to go into details.

Mr. Ruffieux (in French). — Let us therefore delete the words : « such as visibility without considering the importance of the crossing ». (*General agreement.*)

— Clause 10 was carried.

The President. — « 11. The cost of fixing and maintenance of announcing apparatus at level crossings where supervision has been dispensed with, could be distributed between the Railway Administrations and the authorities interested in traffic on the roadways. »

— Carried.

« 12. With the reservations mentioned above, opinion should be influenced so that the public may see to its own safety when negotiating level crossings. »

— Carried.

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# DISCUSSION AT THE GENERAL MEETING

Meeting held on the 27 June 1925 (morning).

PRESIDENT : THE RIGHT HON. VISCOUNT CHURCHILL.

GENERAL SECRETARIES : Sir HENRY FOWLER and Mr. P. GHILAIN.

Sir Henry Fowler, *General Secretary*, read the final summary adopted by the 1st section.

The President. — We will now go back to level crossings, and I will call upon Mr. F. Level.

Mr. F. Level, *Local Railways Company, France (in French)*. — I have to thank the President for allowing me to make a few brief remarks.

The members of the 5th section were occupied in their own meeting at the time when the members of the 1st section were discussing the question of level crossings, and it was therefore impossible to take part in the discussion with their colleagues.

If they had been able to, they would have laid special stress on the fact that the final summary should only apply to main lines, as they attach very great importance to a distinction being made between the subject of level crossings for main lines and for light railways. I ask in the name of the section to add to clause 12 the following

Addition to the final summary :

« 13. — The above recommendations apply only to main lines and do not refer to light railways. »

Mr. Wasiutynski (in French). — There is a difference between secondary

lines and light railways. In our opinion secondary lines come within the scope of the recommendations which we have arrived at with regard to level crossings.

Sir Henry Fowler. — I think « light railways » is the phrase by which we understand it in English. There has been a very considerable discussion on the question of what a light railway is. This is not the place in which we should define it, but I think my English-speaking colleagues will agree that the words « light railways » are comprehensive and will meet the case.

Mr. F. Level (in French). — That is so.

— Mr. Level's proposal was carried.

The President. — The final summary is therefore as follows :

Final summary.

« 1. — The abolition of gate keepers  
« gives important economical advantages,  
« and causes no inconvenience to cross-  
« ings on roads, except where traffic is  
« exceptionally heavy, provided that the  
« field of view of approaching trains  
« from the road is sufficient in all direc-  
« tions;

« 2. — The approach to level crossings,  
« the supervision of which has been  
« abolished, should be notified to users  
« of the road by signals that are visible

« day and night where necessary, and  
« which allow drivers of the fastest run-  
« ning vehicles likely to use the crossings  
« to stop before reaching them. In cases  
« where the field of view is insufficient,  
« these signals should themselves be pre-  
« ceded by advanced signals placed at  
« suitable distances from them. It is ad-  
« visable that these signals should in-  
« dicate the number of tracks that have  
« to be crossed.

« The international signal announcing  
« the approach to a level crossing is not  
« suitable for unattended crossings;

« 3. — Even in those cases where the  
« visibility of trains as seen from the  
« road is insufficient, abolition of gate  
« keeping may take place without incon-  
« venience, on condition that automatic  
« apparatus announcing the approach of  
« trains is placed near the crossings;

« 4. — Level crossings at which gate  
« keeping is dispensed with during part  
« of the day should be provided with  
« special warning apparatus similar to  
« that used on unattended crossings, but  
« hidden from the public view during the  
« period the crossings are under super-  
« vision;

« 5. — A good automatic warning signal  
« working at all hours of the day and  
« night offers a much greater guarantee  
« of safety at nearly all level crossings  
« than the protection given by gate  
« keepers or attendants during a part of  
« the day only;

« 6. — Automatic apparatus announc-  
« ing the approach of trains having two  
« scintillating lights, or oscillating signals  
« that can be depended upon, are among  
« the best forms of automatic signals;

« 7. — Automatic signals that announce

« the approach of trains should, if the  
« apparatus fails or gets out of order,  
« show to road vehicles a danger signal  
« visible both day and night.

« It is desirable that they should not  
« be influenced in the vicinity of stations  
« by operations which do not concern the  
« crossings;

« 8. — Audible warning signals are not  
« as serviceable as luminous signals, and  
« are only justified at isolated crossings  
« of small importance;

« 9. — It is desirable that signals  
« announcing level crossings and trains  
« should be of standard and international  
« type, so that their indications may be  
« understood and observed by all;

« 10. — The Congress might adopt a  
« motion inviting countries, the Railway  
« Administrations of which are members  
« of the International Association, to  
« issue a recommendation that with rare  
« exceptions gate keepers, at level cross-  
« ings where local conditions permit,  
« should be dispensed with;

« 11. — The cost of fixing and main-  
« tenance of announcing apparatus at  
« level crossings where supervision has  
« been dispensed with, could be distri-  
« buted between the railway administra-  
« tions and the authorities interested in  
« traffic on the roadways;

« 12. — With the reservations mention-  
« ed above, opinion should be influenced  
« so that the public may see to its own  
« safety when negotiating level cross-  
« ings. »

« 13. — The above recommendations  
« apply only to main lines and do not  
« refer to light railways. »

— This final summary was adopted by  
the General Meeting.



## QUESTION II.

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### BREAKING OF RAILS. — JOINTS.

- A) *Initial causes of breaking of rails : means employed to reduce the number of these breakages, as much from the point of view of the method of use as from that of the specification of material employed;*
- B) *Rail joints : most economical and efficient arrangement.*
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#### Preliminary documents.

1st report (America), by Mr. W. C. CUSHING. (See English edition of the *Bulletin*, October 1924, p. 677, or separate issue [with red cover] No. 1.)

2nd report (British Empire), by Mr. C. J. BROWN. (See English edition of the *Bulletin*, May 1925 (1st part), p. 1403, or separate issue [with red cover] No. 35.)

3rd report (France), by Messrs. MERKLEN and CAMBOURNAC. (See English edition of

the *Bulletin*, May 1925 (1st part), p. 1289, or separate issue [with red cover] No. 35.)

4th report (other countries), by Mr. J. WILLEM. (See English edition of the *Bulletin*, May 1925 (1st part), p. 1403, or separate issue [with red cover] No. 35.)

Special reporter : Mr. MERKLEN. (See English edition of the *Bulletin*, June 1925, p. 2085.)

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## DISCUSSION BY THE SECTION

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Meeting held on 26 June 1925 (morning).

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Mr. E. F. C. TRENCH, C. B. E., IN THE CHAIR.

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— The meeting opened at 9.30 a. m.

The President. — Gentlemen, we have to deal now with question No. II. We have four exceedingly interesting and able papers, by Mr. Cushing for America, Mr. Brown for the British Empire, Messrs. Merklen and Cambournac for France, and Mr. Willem for other countries. We have this morning's Session,

this afternoon's Session, and one Session on Monday in which to get through this work. A desire has been expressed that this afternoon should be a holiday, and if we make sufficient progress this morning to enable us to finish on Monday morning, I think perhaps it would be the general desire that we should not meet this afternoon; but we will have to

see how we get on, because it is essential that we should finish the papers, and do justice to them, by 1 o'clock on Monday morning. (*Applause.*)

He then called upon the special reporter.

Mr. Merklen, *Special Reporter* (in French). — Gentlemen, I only wish to add a few words to the résumé which you already have.

At the commencement of the reports Nos. 2, 3 and 4, the reporters for Great Britain, France and the other countries, excluding America, after stating that they have prepared a joint questionnaire to send out to the various administrations, have expressed regret that they have not been able to consult the American reporter owing to the distance and the very short time at their disposal.

They note, however, that this common questionnaire has been adopted by Mr. Cushing, and they thank their colleague for taking this step, which has facilitated the work of the special reporter in co-ordinating the information sent in by all the administrations.

I must apologise for not having mentioned in my special report the very interesting historical chapter contained in Mr. Cushing's report. I have tried to avoid increasing the length of my summary, but I think I should now call the attention of the delegates to this historical note which has been prepared on the occasion « of the Railway Centenary which has transformed an ordinary session of the Congress into a pilgrimage from all parts of the world in order to take part in the celebration ».

I am here quoting the words in the Centenary booklet which has been distributed to us.

#### A) BREAKING OF RAILS.

I will now proceed, with your permission, to the question with which we are dealing: Initial causes of rail breakages.

It will be seen from the large amount of information sent in that all the railways are in agreement as to the causes, which were described some considerable time ago by Messrs. Cushing, Gennet and Frémont. These causes are piping, segregation and brittleness, since the secondary causes arising from the conditions under which the rails are used would have no injurious effect if the metal were homogeneous and not brittle.

Among the secondary causes given must be included slipping of engines. This is an important secondary cause which has a serious effect upon the rails.

There is, however, a defect, the initial cause of which is somewhat obscure, this is a transverse fracture in the interior of the section of the rail (generally in the head) which is known by the name of « oval silvery spot ».

This defect probably results from defective manufacture, but it would appear advisable to continue researches on this subject. I might add that my attention has recently been drawn to an article which appeared in the May number of the French *Revue de Métallurgie* on inter-crystalline cracks or micro-piping, and I have compared the theory of micro-piping with the statement given in paragraph 3 of Mr. Cushing's report « Minute shattering cracks which are enlarged to final rupture of the rail » and which may arise from the effects of micro-piping as quoted in the above mentioned article by Messrs. Guillet, Caliboux and Balay.

In order to remedy these defects entirely and to eliminate the majority, if

not all of the breakages, one should obtain from the steel makers rails which are made of homogeneous and non-brittle metal.

With this object, the specifications have become more and more strict, in France for example an impact test is carried out on a notched bar taken from the head of each ingot. In England, in America and in Belgium the specifications, which are very carefully drawn up, have also kept abreast with this aspect of the question, but as Mr. Cushing points out in his very able report « There is the utmost necessity for great and radical steps forward. Twenty-five years of work upon the improvement of the specifications have not brought the result required ».

However, in addition to the introduction of more and more severe conditions in the specifications, the question of overcoming imperfections in manufacture have been investigated by specialists. In the United States in particular there is co-operation between the railways and the steel makers, and it is recognised by Mr. Cushing that it is advisable to further this co-operation, which has already been in practice for several years, for the mutual advantage of both the railways and the steel makers.

Of the more recently tried methods, which are, however, not yet perfected, the following may be quoted :

- 1) Pouring the ingot in an inverted position with a « sinkhead » to avoid piping and to obviate excessive segregation;

- 2) Heat treatment of the rails so as to obtain metal which is not brittle.

It would appear that by the application of these two processes in a perfected state, the steel makers should be able to

produce a carbon steel which is not segregated and sufficiently free from brittleness to allow us to overcome breakages, especially those resulting from cracks in the upper surface of the rail head, and in the parts enclosed in the fish plates.

These two types of breakages, which are the most numerous, have been investigated in the 61st report of Mr. Frémont, whose conclusions are as follows :

« In order to avoid breakages of rails in the parts enclosed by the fish plates, only those rails should be accepted which are not brittle in a direction perpendicular to the direction of rolling. The production of minute cracks is the result of the service to which the rail is subjected, but ordinary steel which is not segregated and not brittle is sufficient to avoid breakages resulting from these minute cracks. »

It may be well, in concluding, to draw attention to the portion of Mr. Cushing's report which deals with the inclination of the rail. After stating that it is not possible to conclude that the method of laying the rail has a favourable or unfavourable effect on the number of defects or breakages, our able colleague expressed his opinion on the much discussed question of whether the rail should be inclined or laid truly vertical. It appears to him that the vertical position is the best, and he meets point by point the ten principal objections of this method of laying put forward by those who are in favour of canting the rail; Mr. Cushing will perhaps allow me to ask him what is the position in America with regard to this question, and what is the opinion of the majority of railways in the United States.



I will now read, with your permission, the general résumé of the special report :

1) Examination of the replies relating to breakages of rails supplied by the various administrations has been made difficult and their comparison impossible on account of the differences in the regulations of the respective administrations under which statistics are drawn up.

It seems desirable that common regulations dealing with the matter should be adopted on the following lines :

A) Definition of breakages : A rail should be considered as broken when completely separated into two or more portions, or when a piece of the head is broken off causing an interruption of the running surface;

B) Classification of breakages according to the weight of the rail per unit of length : These should fall into two categories, one including heavy rails of weight greater than 42.5 kgr., per metre or 85 lb. per yard, and the other including light rails of weight equal to or less than 42.5 kgr. per metre or 85 lb. per yard;

C) Classification of breakages, according to the age of the rails, in the track, viz. : Those having a life of less than 5 years, from 5 to 10, from 10 to 15, from 15 to 20, and beyond 20 years;

D) An index number of the breakages: The total number of breakages, without distinction of weight and age of the rails, on each administration, in relation to traffic density by giving the number of breakages per 10 000 000 tr.-km. or 6 250 000 train-miles.

With regard to this point, one of our colleagues has remarked that it would be better to express this not on the basis of the mileage, but on the tonnage, and with this suggestion I agree.

E) The information to be supplied in the form of the attached table and sent in yearly, before the 31 March of the ensuing year, to the Permanent Commission who will combine the replies for publication.

2) It appears desirable, in order to follow up the study of the question, that administrations should classify breakages both for « heavy » and « light » rails in such a way as to give at least the following particulars :

A) Percentage of breakages in the respective portions of the rails covered by and clear of the fish plates;

B) Percentage of fractures according to the appearance of the fracture :

a) Fresh and clean fracture through the whole of the rail section :

- 1) With « silvery oval spot »;
- 2) Without « silvery oval spot »;

b) Fractures, part of which are old and strongly oxidised extending to the outer face of the foot or head of the rail :

- 1) When the oxidised part is in the foot;
- 2) When the oxidised part is in the head.

c) Fractures with strongly oxidised portions not extending to the outer face of the foot or head of the rail.

3) It appears desirable that the railway systems should take the necessary precautions for proceeding, either on their own account, or in collaboration with the steel works, to an investigation of the initial causes of fracture of rails. In particular, it would appear desirable to study the failures that occur through « transverse fissures », a defect that is

known in France by the name of « silvery oval spot » (*tache ovale argentée*), the primary cause of which is not thoroughly understood.

4) The segregation found in the metal of the greater number of fractured rails appears to be the most frequent primary cause of the fractures observed; the attention of steel makers should be directed to the necessity for continuing to endeavour to secure the total elimination of segregation of the metal, and it is necessary that provision should be made against segregation by suitable requirements laid down in the specification.

It should be borne in mind that segregation is more serious in the case of large ingots.

The weight of ingots, which formerly did not exceed 800 kgr. (1760 lb.), is now in some cases 6 t. or more. In a 800 kgr. ingot the metal solidifies rapidly and sufficient time does not elapse for segregation to take place; with heavy ingots this is not the case, the metal solidifies slowly so that the segregation which results is more excessive when the metal is poured at a high temperature.

It is necessary therefore to pour the metal into the ingots at a temperature as low as possible above the temperature of solidification. This question is well recognised by metallurgists, who should continue to give their attention to this point.

5) Macrographic tests tend to facilitate examination for segregation. It would be desirable to extend the use of such tests, and improve them, so as to make them of practical service in the inspection of rails. The same remark applies to tests of resilience.

6) The heat treatment of rails appears to have the effect of improving the quality

of the metal and reduces its brittleness. It would be of interest to follow up the experiments with heat treated rails, which have given encouraging results in the United States and in France.

7) Among the secondary causes of rail breakages, the most important must be considered to be shocks produced at the joints by the rolling loads. It is advisable therefore :

A) On the one hand to increase the length of rails so as to reduce the number of joints, and

B) On the other hand to improve the design of joints so as to suppress or reduce the shocks caused by the passage of the wheels.

8) It appears possible to prevent to some extent breakages in rails by very careful maintenance of the track and the exercise of close inspection of the material forming it, so as to enable rails to be removed as soon as they begin to develop flaws which may result, before long, in breakages.

Our colleague, Mr. Willem, has just received a reply from Japan to the questionnaire. This reply has arrived too late to be included in Mr. Willem's report. He asks to be allowed to give a summary of this reply, which is of considerable interest.

Mr. Willem, *Reporter* (in French). — The report from Japan contains some interesting statistics as regards rail breakages which have occurred on their railways. The report is accompanied by figures showing the nature of these fractures, and bears out the classification shown in the reports of the various casualties which have occurred.

This classification of the fractures is on similar lines to that of the American

engineers, and which has been laid down in Mr. Cushing's report.

The Japanese report also describes an apparatus known by the name of « magnetic rail defectoscope ».

This apparatus has been contrived for examining from outside without spoiling the rail at all, such internal defects, as, for instance, local segregation of impurities or inhomogeneity of stress (the inhomogeneity of hardness due to external force), and transverse interior fissures caused by nuclei. The examination as formerly carried out was done by means of tensile, compression, bending, torsion and hardness testings, and the portions used for test were unfit for service again. The testing also was based on the assumption that all the materials used were manufactured under the same conditions as to structure and methods of manufacture. But it must be remembered that in such long members as rails, non-homogeneous portions must exist somewhere. With the aid of an apparatus of this kind, such internal defects can be detected very simply and easily by measures of magnetic induction. This apparatus is known as the « magnetic rail defectoscope ».

When a ferromagnetic substance such as iron or steel is placed in a magnetic field, it is at once magnetized by magnetic induction. The intensity of magnetization differs much according to the nature of the substance and the mechanical or heat treatment previously applied. For instance, as is well known, the intensity of magnetization decreases as the content of carbon increases, while the intensity varies according to the method of forging, that is to say, the intensity of magnetization varies according to the condition of stress.

When magnetic permeability is constant throughout the total length of rail

tested, the magnetic flux induced by constant magnetizing force is constant throughout the rail. If, however, magnetic permeability varies owing to some faults existing in any part of the rail the variation in induced magnetism on that part causes a change in the magnetic flux. Consequently the amount of change of flux can be shown by measuring the induction current by means of a highly sensitive galvanometer with an exploring coil over the rail. When magnetic permeability does not vary all along the rail, the flux is constant, and there is no deflection of the galvanometer mirror, as induced current is not produced in the exploring coil. But in cases where a change in the magnetic flux occurs owing to faults existing in any part of the rail, the induced current produced in the coil deflects the mirror of the galvanometer; thus any faults existing in the inner part of the rail can be explored by measuring the induced current. The measurement is done by having a horse-shoe magnet put on the rail head and then made to slide along the rail from one end to another by means of an electric winch. An exploring coil of small silk-wound insulated copper wire is fitted on the surface of the rail between two poles of the magnet and the coil is caused to slide with the magnet so as to cut the flux.

A special recording apparatus marks the deflections of the galvanometer mirror on a paper. By means of this apparatus the presence of any internal defect is revealed by an abnormal deflection of the diagram, as is shown in the figure attached to our report, and anyone who is accustomed to the work can estimate the nature of the defects which exist. This is the principal merit of the apparatus.

The diagrams attached to the report



give comparative results of defective and sound rails, namely :

I. — Curve of the rail having a transverse crack. The galvanometer shows a rapid and long deflection.

II. — Curve of an homogeneous rail showing no deflection except an initial displacement produced at the commencement of the test.

III. — Record of a non-homogeneous rail, a defect visible from the exterior and an abnormal internal tension.

IV. — Curve of a new non-homogeneous rail.

The abnormal deflection which is observed at regular intervals of about 1 metre (3 ft. 3  $\frac{3}{8}$  in.) is due to the abnormal tension produced by the straightening machine. This deflection is of considerable magnitude but is gradual.

From the experience of the various laboratories and railways of the Japanese Government, it is possible by means of this instrument to reveal the following internal defects :

- 1) internal cracks and blow holes;
- 2) segregations and impurities;
- 3) abnormal internal tension.

Of these three, the deflection of the galvanometer due to the first mentioned is comparatively rapid and may be distinguished from the gradual deflections due to numbers 2 and 3. As the small amount of segregation or impurities in general is not dangerous, these defects do not prevent the rails from being used. The third is due to abnormal internal tension resulting from straightening the rails during the process of manufacture and may in some cases lead to rail breakages, especially when the carbon content is high. When the carbon content is low, this danger does not exist.

The photograph shows an internal defect consisting of a transverse crack revealed by an actual examination of the magnetic defectoscope carried out upon a rail in service. It is of remarkable interest that the apparatus allows such a defect to be discovered in rails which are apparently sound.

The merit of the apparatus is its simplicity and the facility with which it may be used. One can test rails in service in a very short time (about two minutes per rail) without removing them from the track. It is intended to design a perfected and portable instrument capable of revealing serious faults of rails in service, and for testing new rails at the time of purchase.

**The President.** — I think we had better confine our consideration this morning to the breakage of rails, and leave the question of rail joints for Monday. Mr. Merklen, special reporter, has given us a most admirable review of the papers which we have before us. Unfortunately no translation has been made of this review, and I am afraid that I should not be able to do justice to it if I attempted to translate it in summary form, which would be all that I could possibly do. I think perhaps the best plan will be to have that review translated and printed in the Daily Journal.

Mr. Willem has given us a most interesting account of certain investigations recently undertaken in Japan, and I understand that there is an English translation of that. The matter appears to me to be so exceedingly interesting that I think that translation ought to be read in English for the benefit of those of us who have not understood the French version well.

**Mr. L. W. R. Robertson, Secretary,**

then read the English translation, of the Japanese report.

**The President.** — Gentlemen, that appears to me to be something quite new, and something which will engage our attention and interest for some considerable time to come. I do not think that we can investigate the merits of this particular apparatus to day, but it is very interesting that it should have been brought forward at this meeting — unfortunately not until the last moment, so that we have not had an opportunity of considering it beforehand.

Now, Gentlemen, in default of a translation of the summary of the papers, I think perhaps it would be interesting if we were to read the short summary of each of the papers which have been given to us, and then ask the Reporter responsible for that paper to address us shortly. I would ask the Reporter, if he would be good enough to do so, to emphasise especially, and to confine his remarks as far as possible to, such matter as has struck him as being new, and as indicating the present direction in which investigation and research ought to take place. The field is a wide one, and it will not be possible for us to range over the whole of it. Therefore I would ask the Reporters to draw attention to such matters as have struck them as being new, and possibly original, since the last Congress three years ago. I will ask that the short summary (which appears on page 2088 of the June *Bulletin* in the English edition) of Mr. Cushing's paper be read, and then Mr. Cushing will perhaps be good enough to address a few remarks to us on the general subject.

**Mr. L. W. R. Robertson, Secretary,** read the final summary, published in the June 1925 number of the *Railway Congress Bulletin*.

**The President.** — Mr. Cushing, I quite appreciate that this very short summary does nothing like justice to your excellent paper. We shall be obliged if you will speak a word or two upon that summary, and bring out any points in which you think it does less than justice to your paper.

**Mr. Cushing, Reporter.** — Gentlemen, this being the centenary of railroad transportation, I have taken the opportunity to use the circumstance for outlining the endeavour of railroads in the past to keep up, in the quality of the rails they use, with the conditions of the transportation service which have been placed upon the engineers of maintenance, in order to take care of that traffic in the best and safest way. Up to about the year 1876 it was the custom, at least on the Pennsylvania Railroad System, to leave to the manufacturer entirely the question of the contents or ingredients of the rail steel, and the method of manufacture, without any suggestion on our part in regard to it. At that time the conditions of traffic service were becoming so severe, railroad engineering was progressing, and railroad transportation was increasing so rapidly, that it was found that the rails were not keeping up with the requirements; and it was deemed, on consultation within the Pennsylvania Railroad System, that it would be necessary for the railway engineers to have something to say in regard to the contents and method of manufacture of rail steel. About that time, after a very careful investigation by the metallurgists of the company, a specification was issued of which I have given an outline in my report. Ever since that date, changes in the specification have been made from time to time in order to bring about further improvements in the qua-

lity of rail steel, and in order to keep up with the railroad requirements. It has been a matter of so much interest in the United States that the American Society of Civil Engineers on three separate occasions has taken up the study, by the appointment of committees for that purpose, and doubtless many of you have seen those admirable reports which have been published in their proceedings. Still, the progress was not sufficient: the railway engineers were always behind the traffic requirements with reference to the quality of the rail which was necessary; and following that, the railway engineers themselves in 1899 formed a Society, the American Railway Engineering Association, one of the chief objects of which was the study of these matters in regard to maintenance in quality and safety of railroad transportation. Ever since that time up to the present, numerous careful studies have been made of the specifications in order to bring about the required improvement. On those roads where the traffic is heaviest, we do not believe that specifications have brought about the required improvement, and we believe that it is not altogether possible at the present time to meet the necessary requirements by these small changes in specifications. We have had the entire co-operation of the rail manufacturers on these questions; but it appears to have reached a point on the heaviest traffic roads where we are actually demanding service from the steel which it is incapable of giving, and that is why I have emphasised in the report that an entire change in the manufacture of rails is desirable, if it is possible to find the best way to do it. Several different ways have already been suggested for this improvement. One of these methods which has not been taken up as yet to any great extent in the United

States, except for the manufacture of steel for special purposes, is what is known as the « sink head » method introduced by Sir Robert Hadfield at his Sheffield works, which he has used for many years in the manufacture of special steel, particularly during the war in the manufacture of shells, in which the highest degree of perfection is required. Indeed, in the United States, whenever steel of that kind is required, the « sink head » method is used. We have strongly advocated its use and extension to the manufacture of rail steel, and feel perfectly confident that it will result in a great improvement in homogeneity and strength and safety. But we are uncertain that that is sufficient, owing to the number of failures arising in the United States by reason of the heavy service and so we have advocated something even more radical than that, and have our minds set at the present time on the possible use of heat-treated steel for rail service, just as it is now used in locomotive service, where the highest strength is required. We expect to get the additional high elastic limit which is positively necessary, and at the same time we can obtain, as we know from experiments carried on, greater resistance to the abrasive action of the wheels. It is to bring about the greater study of that kind of steel for rail use that my report has been prepared.

As regards the inclination of the rail upon which question I have been consulted by Mr. Merklen, I may say that a committee of the American Railway Engineering Association has been studying this subject for several years but owing to quite widely divergent views a report has not yet been presented as a common basis for action.

The subject therefore, is still under study at the present time.



There is, however, in the United States quite a widespread opinion in favour of inclined rail, and quite a number of railroads are laying rails inclined for experimental trial and quite a number of other railroads have already made the plan standard for their System.

None of these railroads, however, carries the inclination of the rail through the frogs and switches of turnouts and crossovers, but in every case of turnout or crossover the rail is brought down from inclination to vertical position without any special arrangement or device in order to make the transition uniform and gradual. This is directly contrary to the European practice.

The Pennsylvania Railroad has not yet decided that the practice of laying rails inclined is better from all points of view than laying it vertically, and the reasons for this were given in my report.

We are, however, continuing the study in order to prove the advantage of either one or the other to our own satisfaction. Such comparative trials of both plans which we have already made have as yet shown no advantage for the inclined rail.

Mr. Merklen (in French). — In France the majority of railways lay the rail vertically throughout points and crossings.

The President. — We will now read the summary of Mr. Brown's paper.

Mr. L. W. R. Robertson, *Secretary*, then read the summary (page 2095 of the English edition of the *International Railway Congress Bulletin* of June 1925).

The President. — Mr. Brown, do you wish to add any remarks to that summary?

Mr. Brown, *Reporter*. — Mr. President and Gentlemen; I think one of the principal points brought out as the result of the inquiry is the great variation which

exists between Companies and between countries in the making of returns. It is quite evident that they are made up on entirely different lines, and anything which would introduce a system whereby uniformity could be arrived at and the results made comparable would be of very great advantage. That is particularly noticeable in the figures which I received from the Canadian National Railway. When these figures are compared with the results of the British railways, it is evident that there is some very great difference; and this arises from the fact that all defects, whether rails are broken or merely flawed, are reported. I think it is advisable to make this explanation, so as to show why, in Table I of my report, the figures should be at such variance.

The other matter which I think the returns bring out very strongly is the fact that by far the greater number of the breakages arise at the joints, showing that that is much the weakest part of the track, and anything which can be done to eliminate or reduce that weakness would be of great advantage. That of course could be partly effected by the lengthening of the rail.

The problem of rail breakages in this country presents, of course, nothing like the difficulty which Mr. Cushing and his colleagues have to meet with in America, on account of the different loading and weather conditions, so much so that I would say that in this country the problem of broken rails as such may hardly be said to exist; though of course wherever there is a possibility of broken rails, this must always give rise to anxiety on the part of the engineer responsible for maintenance.

I do not think I have anything more that I wish to add to the report which I have made.

The President. — Now we will take

the summary of the report of Messrs. Merklen and Cambournac.

Mr. Merklen, *Special Reporter* (in French), read the summary of the report which he had prepared in conjunction with Mr. Cambournac, which was published in the June 1923 number, page 2085, of the *Bulletin of the Railway Congress*.

He added, I have completed this report by the remarks which I have just read to you. I would say, as regards the initial causes of rail fractures, that it will be seen that the information sent in from all the railways agrees with the causes which have been described a long time ago by Messrs. Cushing, Gennet and Frémont. It arises from piping, segregation and brittleness, but there is also a defect, the initial cause of which remains obscure, that is, transverse cracks in the interior of the rail head which is known under the name of « oval silvery spot » which defect probably arises from faulty conditions of manufacture.

My attention, I might say, has been drawn to an article which appeared in the *Revue de Métallurgie* on intercrystalline piping or micro-piping.

I have co-ordinated the theory of micro-piping with the statement made in Mr. Cushing's report. I will read to you, if you will allow me, a paragraph from the *Revue de Métallurgie* which explains micro-piping :

« Independent of the crystals formed by contact with the walls of the mould, a nuclei of crystals may appear in the centre of the liquid mass, which is soon completely permeated. Then as cooling progresses, all these crystals develop and the interior of the mould after some time becomes a sort of solid sponge, the interstices of which contain the mother liquid. These interstices communicate with each other more or less at the com-

mencement, but they afterwards become isolated, and when the isolated liquid reaches the final temperature of solidification, the contraction of solidification creates a void, that is, micro-piping. »

Since I prepared my summary, my attention has been drawn to internal cracks in the standardised rail sections used on the French railways, these cracks being at the bottom of the web near the foot of the rail. A metallurgist whom I have consulted on this subject has expressed the opinion that micro-piping may be the initial cause of these defects.

Mr. Cambournac, *Reporter* (in French). — As far as I am concerned, I have only a few things to add to what has been already said by Mr. Merklen.

I have noticed in comparing the reports prepared in connection with this subject, that in the different countries the types of fractures are the same, but that each category occurs more or less frequently in accordance with the nature of the traffic. Fractures due to a longitudinal defect in the head or in the web occur in much greater proportion when the traffic is not very heavy. When, as in America, the traffic is heavy, transverse fractures are more likely to occur. It appears that the form of these fractures is independent of the method of manufacture of the steel (Bessemer, Thomas, Martin).

We have asked the reasons why the American railways use Martin steel for their rails in preference to the Bessemer steel used formerly. Mr. Cushing has replied that the Bessemer process does not easily lend itself to the production of a steel with the carbon content required by the railways. When the axle load has been increased, the Americans have found a crushing of the head of the rail head. They considered that the solution

lay in increasing the section of the rail and using a harder steel, and to increase this hardness it was necessary to increase the carbon content, which could not easily be done with the Bessemer process.

Moreover, in accordance with what Mr. Cushing tells us, a reaction has set in in America against the use of too high carbon steel, which leads to the metal being very brittle, and facilitates the formation of transverse fractures experienced on the American railways.

The preference given to Martin steel in America therefore loses its justification.

Mr. Willem, *Reporter* (in French). — The various railways which I have consulted in drawing up my report differ so widely as regards their locality, importance and traffic conditions, that it is not to be wondered at that the answers obtained are sometimes vague and rarely agree.

In accordance with the reports received, I find that on the more important railways, especially on the Dutch, Italian, Swedish and Swiss State Railways, the question of rail breakages is an important one, unfortunately each administration has its own method of dealing with the problem. The time has come, it appears to me, for the Congress to give the lead in this direction and advise the different railways how the investigation may best be carried out. This is the reason why my colleagues and I have recommended a standardised method of classifying rail breakages, which classification is very similar to that in vogue in America. We consider that it is only by this means that one can hope to produce useful statistics.

In investigating fractures, it is necessary to carry out an examination of the internal structure of the metal by micro-

graph or other examination. Certain railways have not hesitated to obtain the staff and laboratory equipment necessary. I consider that the employment of competent specialists is to be recommended.

There is one point to which I think I should draw your attention, and that is to the question of impact tests. It is certain that impact tests will form sooner or later one of the principle methods of testing steel, but I think it would be difficult now to decide upon the requirements in the specification as regards impact tests, especially where steels made by different processes are concerned.

On the Belgian State Railways we carry out these tests for our own personal interests, but we cannot very well specify any figure for impact tests, and in any case we have to continue to use the same class of steel. From whatever maker this is obtained, the process of manufacture is identical. The important question for us and for a number of administrations is to determine the impact figure which is to be laid down in the contract conditions.

I consider that a macrographic examination is a good method to give a rapid indication of the quality of the rail.

The micrographic examination should be very strongly recommended.

As regards sorbitic steel, the principles of its employment are fairly well defined. It should be used for rails which are subjected to exceptionally heavy stresses, such as on curves of small radius.

Finally, I might add that the cost of special steels very largely limits their use, and for this reason in Belgium only carbon steel is employed. (*Applause.*)

The President. — We will now proceed, Gentlemen, to the general summary, and endeavour to arrive at conclusions under the various heads which are given



there. Mr. Descubes has suggested that it would perhaps add interest to the discussion, and also make the task of the interpreters and translators easier, if members who speak would stop at short intervals to allow of their remarks being translated as they go along. That seems to me quite a good idea, but it must rest with the speaker himself to stop, in order to allow the translation to be made. I leave it entirely to the discretion of the speaker.

The first section of the general summary reads as follows :

Examination of the replies relating to breakage of rails supplied by the various administrations has been made difficult and their comparison impossible on account of the differences in the regulations of the respective administrations under which statistics are drawn up.

It seems desirable that common regulations dealing with the matter should be adopted on the following lines :

A) Definition of breakages : A rail should be considered as broken when completely separated into two or more portions, or when a piece of the head is broken off causing an interruption of the running surface;

B) Classification of breakages according to the weight of the rail per unit of length : These should fall into two categories, one including heavy rails of weight greater than 42.5 kgr. per metre or 85 lb. per yard, and the other including light rails of weight equal to or less than 42.5 kgr. per metre or 85 lb. per yard;

C) Classification of breakages, according to the age of the rails, in the track, *viz.*: Those having a life of less than 5 years, from 5 to 10, from 10 to 15, from 15 to 20, and beyond 20 years;

D) An index number of the breakages: The total number of breakages, without

distinction of weight and age of the rails, on each administration, in relation to traffic density by giving the number of breakages per 10 000 000 tr.-km. or 6 250 000 train-miles;

E) The information to be supplied in the form of the attached table and sent in yearly, before the 31 March of the ensuing year, to the Permanent Commission, who will combine the replies for publication.

Gentlemen, you have now heard the recommendation in this first item of the summary. I think it must be admitted that something is necessary in this respect. All the Reporters have stated that they have great difficulty in making comparisons between the returns of the various countries and the various administrations in those countries. There is a lack of uniformity in the method of making the returns, and the suggestion put forward now is that a form of return should be drawn up, and that the railways who are members of this association should undertake to send in annually a full return, on the lines indicated, of all broken rails. I have no doubt that such a return would be of immense value.

Would any gentleman like to speak upon this subject? We must endeavour, I think, not to go too much into the detail of the form of the report, but if it is thought that this form of report is either too detailed or not sufficiently detailed, we should be glad to hear the views of the members on those points.

Mr. Ray, Delaware, Lackawanna & Western Railroad. — I want to make this suggestion : that while this form of report might make a fair comparison for the railroads on the continent, you would not be able to compare the breakages in the United States and Canada on this basis, on account of the heavy wheel loads

which we have as compared with the lighter wheel loads here. We have a standard method of comparison on all the various roads in the United States and Canada which we attempt to follow, and reports are made regularly to the American Railroad Association. The number of failures per million tons is one of the comparisons used. That method is all right where wheel loads are reasonably uniform on all roads, but it will not work in such a comparison as we are considering because the average axle load on our cars is getting up to about 30 000 or 35 000 lb. We have axle loads on many of our cars as great as 50 000 lb., while the axle loads on our locomotives run up to 70 000 lb. with regularity. Therefore you will readily see that a comparison of breakages so as to determine the cause of breakages of rails could not very well be made on the basis suggested here so far as the United States and Canada are concerned.

**The President.** — Before you sit down, will you tell us whether you have any suggestion to make which would meet the point which you have raised ?

**Mr. Ray.** — The only suggestion I have to make is that you might add a column, or a footnote, indicating roughly the average wheel loads, which would give one a chance to make a comparison; otherwise the comparison would be impossible.

**Mr. Jullien, Paris-Orleans Railway (in French).** — It may be pointed out that if the axle load is very much greater in America, the weight per metre of rail is also increased in an equal proportion.

**Mr. Henry, Eastern Railway, France (in French).** — In agreement with the special reporter, I propose that we substi-

tute ton-kilometres for train-kilometres. This is a matter of importance for certain railways. On the French Eastern Railway in particular, the average weight of freight trains has increased in recent years from 450 t. to 850 t., and it will be seen that in this way the statistics will be misleading if they are based on tr.-km. The table should at any rate include a remarks column in which the nature of the traffic would be stated. It is evident that the rail would be more highly stressed by one train load of minerals passing over it than by a light engine.

**Mr. Maison, Ministry of Public Works, France (in French).** — I am of the opinion that statistics for rail breakages are extremely important, but these can only be of real utility provided that they are accompanied by as full information as possible on the principal causes of breakages; the table should therefore, in my opinion, give the breakages classified in accordance with the principal causes.

I know that these causes are difficult to define, but, however, one would soon get into the method. A bald statement that there were so many breakages per ton would not be of any very great use; it is much more important to know the nature of the breakages which have occurred.

**Mr. Henry (in French).** — This point is dealt with in clause 2.

**Mr. Merklen (in French).** — Yes that is so.

**Mr. Maison (in French).** — I am still strongly of the opinion that the table should be completed in the way which I have just indicated, so that one may make a comparison between the statistics for the different countries.

**Mr. Cambournac (in French).** — I do

not think it would be possible to do as Mr. Maison wishes, because very few of the broken rails are sent to the laboratory to have the cause of their breakage investigated; the information which is given is only as regards the form or appearance of the breakage.

I agree with Mr. Cushing in saying that statistics should be kept in accordance with the most frequent form and appearance of fracture and not in accordance with the cause. It is obvious that any given form of fracture arises as a rule from the same cause. In order to give statistics on the causes, it would be necessary to send all the broken rails to the laboratory and have them examined.

**Mr. Maison** (in French). — Such an examination would be of very great interest.

**Mr. Cambournac** (in French). — The most important point is as regards rails which are being manufactured in accordance with the new specifications, but it is not a matter of very great interest in the case of rails made 15 years ago and manufactured by methods which have now been abandoned.

**Mr. Merklen** (in French). — I agree with Mr. Cambournac. There are two things to be taken into consideration, the past and the future. As regards the past, we can do nothing; for the future, we can do a great deal, and it is with an eye to the future with which we must work.

In France, we have drawn up a new specification which is extremely strict, much more strict than that used in other countries. We are carrying out very careful examinations of the causes of breakage which have occurred in rails manufactured in accordance with the new specifications. We propose to keep very

complete statistics and to introduce new clauses in the specification if these are thought to be necessary.

I have just said that as regards the past we can do nothing. In practice, when we find that the rails are faulty or that they break, there is only one thing to do, to take up as many as necessary and replace them. We may perhaps have to incur considerable expense in this respect, but it is the only thing that one can do.

**Mr. Maison** (in French). — I quite realise that it is for the future that one must make provision, however, it would appear that the past is also of interest, since in the proposed statistics mention is made of rails of more than 20 years old. It appears to me that considerable account is being taken of the past.

I maintain that it is not sufficient to record the number of breakages, but that in the interests of safety it is especially important to know the causes of breakages, even when these have occurred in old rails. Therefore, in my opinion, it is necessary to make an examination of each broken rail in order to determine the cause. With this end in view, I consider that it is advisable to add the statistical table which has been proposed, a column classifying the breakages in accordance with the cause, this is the only way in which one can improve the present situation on the railways.

**Mr. Merklen** (in French). — **Mr. Maison** has just said that it is of very great interest to know the cause of breakages in old rails. I may say that as regards the past the railways have followed the question very closely. Thus, on the Alsace-Lorraine Railways, having experienced rail breakages in a tunnel, we have not hesitated to completely relay



the track, and have no doubt other administrations do the same as we do, that is to say, that when they find that a certain batch of rails give rise to a large number of breakages, they immediately take the only effective step, which consists of relaying the track.

However, the keeping of very complicated statistics drawn up after an examination of the rails in the laboratory should not in my opinion, be insisted upon.

**Mr. Maison** (in French). — I do not wish to destroy the initiative of the administrations, and it is just because I am convinced that they are applying their initiative to this question that I think it would be very easy to classify the breakages in accordance with the cause and thus give much more interesting statistics which would allow valuable comparisons to be made between the different countries.

**Mr. Wasintynski**, Polish State Railways (in French). — I recognise that it would be difficult to adopt a classification which might be suitable for all the different railways; however, I consider that it is necessary in the statistics to quote the ratio between the average weight and the average axle load; in this way one would take into account the influence of the load on the number of rail breakages.

Under heading *B*, which deals with the classification of breakages, in accordance with the weight of the rails, these are divided into two categories, one consisting of heavy rails having a weight equal to or greater than 42.5 kgr. per metre (85 lb. per yard), and the other for rails less than 42.5 kgr. per metre.

I consider that 40 kgr. (80 lb. per yard)

is a better limit to divide light rails from heavy rails.

**The President.** — In order that we may make progress, I suggest that we take this section of the summary item by item. I take it from what has been said by the delegates that there is no difference of opinion on the general subject, that is to say, that a common return should if possible be formulated and made by the different administrations to the International Association. I take it that that is your view, generally speaking. If no one raises any objection to that, we will pass the first proposition :

1) Examination of the replies relating to breakages of rails supplied by the various administrations has been made difficult and their comparison impossible on account of the differences in the regulations of the respective administrations under which statistics are drawn up.

It seems desirable that common regulations dealing with the matter should be adopted on the following lines :

*A)* Definition of breakages : A rail should be considered as broken when completely separated into two or more portions, or when a piece of the head is broken off causing an interruption of the running surface;

*B)* Classification of breakages according to the weight of the rail per unit of length : These should fall into two categories, one including heavy rails of weight greater than 42.5 kgr. per metre or 85 lb. per yard, and the other including light rails of weight equal to or less than 42.5 kgr. per metre or 85 lb. per yard;

*C)* Classification of breakages, according to the age of the rails, in the track, *viz.*: Those having a life of less than 5 years, from 5 to 10, from 10 to 15, from 15 to 20 and beyond 20 years;

D) An index number of the breakages: The total number of breakages, without distinction of weight and age of the rails, on each administration, in relation to traffic density by giving the number of breakages per 10 000 000 tr.-km. or 6 250 000 train-miles;

E) The information to be supplied in the form of the attached table and sent in yearly, before the 31 March of the ensuing year, to the Permanent Commission who will combine the replies for publication.

Mr. Tettelin, Northern Railway, France (in French). — I support Mr. Wasiutynski's proposal that we classify as heavy rails those which have a weight equal to or greater than 40 kgr. (80 lb. per yard) instead of 42.5 kgr. (85 lb. per yard).

Mr. Henry (in French). — A 40 kgr. rail is rather a light rail.

Mr. Tettelin (in French). — I think it would be better to take 40 kgr. rather than 42.5 kgr. as the dividing line between the two categories.

Mr. Stoika, Roumanian State Railways (in French). — I support this proposal.

The President. — We will take paragraph A first. The wording of paragraph A is: « Definition of breakages: A rail should be considered as broken when completely separated into two or more portions, or when a piece of the head is broken off causing an interruption of the running surface ».

May I take it that no one objects to that? (*Agreed.*)

For paragraph B it is now suggested that the weight of 85 lb. or 42.5 kgr. should be reduced to 80 lb. or 40 kgr.; that is to say, as being the dividing line between light and heavy rails. Mr. Wasiutynski and Mr. Tettelin are in agreement upon that suggestion. I would like

to know whether there is any objection to be raised. What have you to say, Mr. Brown?

Mr. Brown. — I should like to point out that the division now suggested would hardly suit the railways of this country. Their almost universal limit is 85 lb., rails from 85 lb. downwards being considered as suitable for secondary and branch lines, the heavy rails being 90 lb. and upwards. As far as I am concerned I should prefer that the 85 lb. and the 42.5 kgr. should stand.

The President. — I suppose that would apply to America too, would it, Mr. Cushing?

Mr. Cushing. — I was going to make the suggestion that the classification should be in three categories instead of two. It is indifferent to me whether it is 85 lb. or 80 lb., I think Mr. Brown is right that 85 lb. would be more acceptable; but there should be another intermediate class, of over 80 or 85 lb. up to 106 lb., so as to include the group which for many years has been using rails from 90 lb. up to 105 lb., it is a very large group, and has heavy traffic. It is only within the last few years that the weight of rail has gone beyond the 105 lb. section used on the New York Central, except on the Belgian Railways, which rose to 116 lb. a great many years ago; but now there is another group using rails which represent a very large jump in weight, including rails from 110 lb. up to 140 lb. and that ought to be the third group; I would say the third group ought to be rails of 110 lb. weight and over.

The President. — When we have such a large range of weights as from below 85 lb. to above 140 lb., it seems very desirable that we should divide the statistics into at least three categories. We will

adopt that suggestion unless any member present considers that it would be objectionable, and has anything to say against it. (*After a pause.*) Then paragraph I (B) is adopted with the modification now suggested, that is to say dividing the classification of rails into three classes. We will now pass to paragraph C.

**Mr. Tettelin** (in French). — As regards the classification of rail breakages in accordance with the age of the rails, I am of the opinion that they should be grouped in periods of 10 years, and not as has been proposed of 5 years. The statistics are already quite lengthy enough, in other words, instead of having five groups, I propose that we should only have three groups.

**Mr. Willem** (in French). — The most important point is to know the condition of rails which have been recently ordered. There is no doubt that the breakages which occur in rails of 20 years of age or more are of less interest than breakages in rails of less than 5 years, that is to say, in new rails which have been manufactured to the new specifications. It is to breakages of the latter category that our attention should be given and for which we should seek to find a remedy. If any modification has to be made to the period, I think that it should be increased.

**Mr. Dreyfuss**, French State Railways (in French). — We must not overlook the fact that rails are not always immediately put into service after they have been made, and we should take into account the time before they are put into service.

**The President.** — Is that important? Is not the important thing the number of years they have been in the line, and not the number of years they have been in the stack.

**Mr. Tettelin** (in French). — We ask that the time that the rail is in service should be shown.

**Mr. Stoïka** (in French). — The classification by intervals of 5 years is in use on a number of administrations and I think that this should be retained.

**The President.** — **Mr. Tettelin**, do you insist on altering the number of years from 5 to 10?

**Mr. Tettelin** (in French). — No. My proposal was only with the object of simplification.

**The President** said that it was the rails in the first category that is to say, the newest rails which are the most important.

**Mr. Henry** (in French). — Those of the first and second categories.

— Paragraph C was adopted.

**The President.** — We will now pass on to paragraph D.

« An index number of the breakages : The total number of breakages, without distinction of weight and age of the rails, on each administration, in relation to traffic density by giving the number of breakages per 10 000 000 tr.-km. or 6 250 000 train-miles. »

It has been suggested by one speaker that the ton-miles should be given instead of the train-miles. There is a difficulty about that, because in many countries ton-mile statistics are not kept.

**Mr. Cushing.** — That has been a source of much argument in the United States for many years. It is well recognised that the ton-mile unit is the proper unit for measurement of rail service, but it is not practicable to obtain it in use for quantitative comparison of rail failures or



rail breakages, which is all that an Association of this kind can deal with. There are two methods of rail study : the quantitative study by an index number in the same way as in commercial life the values of products from month to month are studied by an index number; and that is all that this Association can attempt to do; while the other method of study is by individual metallurgical examination in a laboratory. The Association must depend upon individual papers and reports for that kind of study; it cannot be included in a general tabular statement. So Mr. Merklen's unit could be transferred for approximate use only into the ton-mile basis, which would be quite desirable, and would avoid this difficulty of comparison between the Continental service and the American service. It would not be possible to give the figures accurately, but approximately only; and that is why Mr. Ray made the statement which he did in that way. It would therefore be a little better, rather than merely to put a note in regard to axle loads, to attempt an estimated tonnage basis as a unit.

**The President.** — I am not quite sure that that meets your point, Mr. Ray, does it? It seems to me that it makes no difference whether the load is carried as ton-miles or train-miles; what you wanted to bring out was that in cases where the axle weight is very heavy, it is a different factor altogether, and therefore should be notified on the return so far as rail breakages are concerned?

**Mr. Ray.** — Yes. I think the total tonnage carried is a very important thing; and I believe that the axle load carried is also a very important thing, judging by my own experience.

**The President.** — It has been sug-

gested, I think, that the intensity of the axle load does not matter, because the rails are correspondingly heavier; but unfortunately rails are not always correspondingly heavier, and it seems quite evident that if you run 30 ton axle loads over, say, 73 lb. rails, the chances are that they will break, and therefore if that is going to happen you ought to know about it.

**Mr. Tettelin** (in French). — I regret that in paragraph *D* it is stated that the number of rail breakages should be given without distinguishing between rails of different weights. I think that this figure should be given separately for different groups of rails.

**The President.** — I am not quite sure that we quite understand Mr. Tettelin's remarks. On the suggested table you find at the side : « Heavy rails », and « Light rails ». We are now going to have three categories, and under those three categories will appear the number of train-miles or ton-miles, which ever we decide on, which run over those particular rails. Does not that meet the point?

**Mr. Tettelin** (in French). — The table will not give separately the number of ton-kilometres for very heavy rails, heavy rails and light rails; it will give the result for the railway taken as a whole. However, for the statistics to be complete, these should show the average number of trains per kilometre of each of the three categories, that is to say, they should give the intensity of the traffic over each category of rail.

**Mr. Wasiutynski** (in French). — I support Mr. Tettelin's proposal.

I should prefer that the ratio between the average weight and the average axle

load be given, as this is of very great importance.

By expressing the total number of rail breakages as a ratio of the average axle load, we should have an exact figure. The average weight and the average axle load may be given by all the administrations, and by using the ratio between these two factors we shall have some very valuable information as regards the number of breakages.

**Mr. Descubes**, Eastern Railway, France (in French). — I think it would be advisable to distinguish between the heavy rail and the light rail, and that less on account of the strength of each of these than on account of the difficulties in rolling as effected by the section. It is obvious that rails of 30, 40, or 50 kgr. (60, 80 or 100 lb.) do not behave in a similar manner from the metallurgist's point of view.

It would appear that great importance should be attached to the ratio between the axle load and the weight or section of the rails. For my part, I consider that any figures are insufficient which do not take into account the spacing of the sleepers. There is no doubt that in a track laid with light rails carried on sleepers which are some distance apart, the stress set up in the metal will be much greater than in a track consisting of heavy rails with the sleepers closer together.

If, however, you require statistics which are easy and simple to keep, you must not go too deeply into the matter.

**The President**. — Have you any suggestion for altering the table Mr. Descubes?

**Mr. Descubes** (in French). — No, I consider that the table is quite complicated enough already.

**Mr. Desprets**, *Principal Secretary* (in

French). — Do you not think Mr. Descubes that it is advisable to include as a remark, with respect to the weight of the rails, the maximum axle load?

**Mr. Descubes** (in French). — One might put the maximum axle load in the remarks column.

**Mr. Desprets**. — Certainly.

**Mr. Wasiutynski** (in French). — I do not quite follow Mr. Descubes' objection. I suppose he wishes to imply that the ratio between the average weight and the average axle load is not always entirely satisfactory on account of certain other influences, such as spacing of the sleepers. I might point out that there are still other factors which should be taken into consideration. This, however, is not a reason for excluding a factor which is the most important and the most easy one to take into account.

**Mr. Desprets** (in French). — As regards the stresses set up in the rail, strictly speaking one has to take into consideration, not only the weight in the section, but also the spacing of the sleepers. This spacing is not always the same, but varies on the different railways. Apart from the spacing of the sleepers, there is the length of the same, the type of sleeper, and finally the nature and depth of the ballast. All these factors have an effect upon the stress set up in the rail. It is, however, impossible to draw up a ratio as exact as one would wish between the axle load and the weight of the rail. While the maximum weight of the rails vary on various administrations, we know that the axle loads on European railways are roughly speaking the same. Some French railways have maximum rail weights of 45 kgr. while on others it is 50 kgr. with the same axle load.

Before the war, in Belgium, we had 50 kgr. rails which carried the same axle loads as the rails on the French railways.

**The President.** — I think it is generally admitted that there should be some notification as to the axle loads. I had noted on my table a suggestion that there should be a notification of the average load on wagon axles, and the average load on engine axles. The proposal now before the meeting is that there should be a return as to the maximum axle load on engines and wagons. What are the views of the members upon that subject? What have you to say, Mr. Ray, as to the best indication? Do you want the average load, or do you want the maximum load?

**Mr. Ray.** — The average wheel load is really what finally determines your wear, and the breakages of your rails; but I think it is also well in reporting to indicate what the maximum wheel loads are. This is an easy matter, and will give the man who is tabulating the results of the reports a chance to judge as to the proper tabulation.

**Mr. Cambournac (in French).** — The various reporters have had experience of the objections which have just been put forward as regards the determination of the index figure. They have realised that in expressing this as a ratio of the number of train-kilometres they have had to neglect a number of factors which should have been included in order to facilitate comparisons between the various countries. They have also taken into account the complications which would result from the inclusion of these factors in the statistics.

They have thought that it was essential to avoid these complications and that it is advisable, as has been pointed out by Mr. Descubes, to draw up as simple a

form as possible, which would give an answer to this question. On a railway of such and such a length with a given amount of traffic, how many rail breakages do you have, that is to say, how many chances of accidents are there as a result of broken rails? A table of this kind would allow the proportion of breakages per train-kilometre to be obtained. If this proportion differs on various railways, one could look for the reason.

Mention has been made of the effect of the weight of the rail, of the spacing of the sleepers and of the nature of the ballast. It cannot be denied that these factors may have an influence, but when the rail is heavy, the ballast and the sleepers are proportional, and we must assume that the tracks are constructed in the best possible way having regard to the traffic which they have to carry. If therefore it is found that the average number of breakages differs from that on another railway having a similar traffic, one would naturally look for the reason of this difference.

The object of the statistics is not to explain the difference, but to draw attention to its existence.

It has appeared to the reporters that it is necessary to confine themselves to information of a general nature, and in their name I would urge that the form of statistics which they recommend should be adopted.

**Mr. Merklen (in French).** — Mr. Henry stated that the Special Reporter agrees with him as regards the substitution of ton-kilometre in place of train-kilometre. We have had a discussion on this point, and during our interchange of opinions, our colleague, Mr. Duchatel of the Eastern Railway, France, has taken part. Mr. Henry has asked him if it would not be possible



in the statistics to substitute ton-kilometre for train-kilometre. Mr. Duchatel considers that this is possible, and therefore I support Mr. Henry's proposal.

**Mr. Henry** (in French). — Provided that there is a remarks column, I do not wish to press this point.

**Mr. Quinquet**, Paris-Lyons-Mediterranean Railway (in French). — I consider that the principal task of the Congress is, in the first place, to institute international statistics on rail breakages.

If these are to satisfy all the proposals which have been put forward — and they are very many — we shall have to draw up a very complicated table, and this is perhaps undesirable. I consider therefore, for my part, that it would be better to adopt the proposal put forward by the reporters.

If at the next Congress the administrations consider that the statistics should deal with other factors with regard to rail breakages, there is no reason why such modifications should not be made to the statistics in order to include these additional factors. However, for the time being we should try to institute something which at present does not exist, that is to say, international statistics on rail breakages.

**The President.** — Gentlemen, I am going to ask you to agree to the table as drawn, with one or two additions, such as axle loads, which have been suggested. The majority of those present appear to think that the table as it stands will give us valuable information. It may not give us all the information that we want, but it is capable of being revised, perhaps at the next Congress, and I feel sure that if we can get these returns made yearly in the meantime, it will give us some-

thing to go on. I rather agree with Mr. Quinquet when he says that it is possible to suggest all sorts of improvements, and that we might go on suggesting improvements from now until to-morrow; but it seems to me, and I think the majority of those present agree, that we had better have the statistics suggested here than no statistics at all; and unless Mr. Tettelin presses his point very strongly, I propose that we adopt the table as now before us.

I think we will put that to the vote. Will those who are in favour of adopting this table as it stands, with the addition of the note as to axle weights, please hold up their hands... On the contrary? That is carried unanimously.

**The President.** — We will now pass on to paragraph *E*.

I would ask if it is essential that the date, namely, the 31 March, should be adhered to.

**Mr. Cushing.** — The railroads in the United States use the 31 October as the ending of the year for the compilation of their figures.

**The President.** — In England we use December 31 for some peculiar reason.

(A discussion in French took place between Messrs. Henry, Depoorter, *Secretary*, Cambournac and Willem.)

**Mr. Cambournac** (in French). — The date given is not the end of the statistical year, but is the date by which the information should be sent in.

**The President.** — As I understand it, the statistics will run for a year, but the actual day of starting and terminating that year does not matter; the only point which is essential is that they should be

sent in before March 31. If that is agreed, gentlemen, we will adopt paragraph *E*.

— Paragraph *E* was adopted.

**The President.** — In view of the fact that we have made very considerable progress with the discussion of this

subject, and that we have got through, I think, the most difficult part of it. I think we may quite safely leave the remainder for Monday morning.

The meeting terminated at 4.10 p. m., and the remainder of the discussion was adjourned until the next meeting.

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**Meeting held on 29 June 1925 (morning).**

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**Mr. E. F. C. TRENCH, PRESIDENT IN THE CHAIR**

**The President.** — Gentlemen, Sir Henry Fowler, one of the General Secretaries, would like to say a word or two.

**Sir Henry Fowler.** I have been very interested in reading through these two papers in my capacity as Editor of the English Bulletin, but I want to say one word with regard to segregation, as alluded to by Mr. Cushing. The method of expressing the amount of segregation by the variation of the percentages of carbon in two arbitrarily selected parts of the rail section is open to objection on several grounds. It is true that many cases of segregation will be detected by such methods, but the measure and intensity of the same will not always be in accordance with the actual facts. In all cases of segregation which have been investigated at Derby (and you will appreciate that we take an intense interest in it) it has been invariably found that the impurities, sulphur and phosphorus, are segregated even to a greater extent than the carbon, and I feel very strongly that the better method would be to take a sulphur print rather than to depend upon the carbon as giving you the amount of segregation. I have here some prints from rails, roughly in the same position as Mr. Cushing has taken, in which the

carbon is 0.68 % as against that in the central core of the so-called pure metal, where it is 0.56 %. The phosphorus in the first case is 0.083 % and in the second it is 0.039 %; the sulphur is 0.046 % and 0.013 % respectively which is a very much higher difference than you get in the carbon. In other cases which we have taken for locomotive material we have found the same, that the true sign of segregation cannot be obtained by taking the carbon. I wish to suggest that even with rails taken in the mill, it would be very much better indeed to take a plain sulphur print by means of the bromide method. In order to carry out this work rapidly on some locomotive material which we have had, we have found that if you take a comparatively speaking rough and uneven surface and grind it by means of a small wheel, you can very rapidly, in a few minutes, obtain a surface sufficiently smooth to take a bromide print which, as we all know, can be done in a very short time. I therefore wish to suggest that although this is not a thing which I think you will agree, troubles us here very much, if it is necessary to ascertain the segregation from the rails at the mill, a bromide print showing the sulphur segre-

gation should be used. It has been said by a very eminent metallurgist in this country, although I may say from the start that I do not agree with him, that if we had no sulphur in our steel we should add some in order that we might trace the segregation of the phosphorus and other undesirable impurities.

The only other point that I wish to deal with is with regard to that other very wonderful paper (and they are all wonderful papers) which has been written by Mr. Merklen and Mr. Cambournac, in which at figure 78 there is a macrograph of a rail head which is stated to be highly segregated. I know it is a matter of opinion, but although there is intense segregation in certain small parts, I should hardly look upon that as being a highly segregated section. I think that a macrograph is a very laborious method of obtaining what you might obtain very rapidly by the sulphur print method of which I have spoken.

I am obliged to you, Mr. President, for your courtesy.

**The President.** — We have heard Sir Henry Fowler's remarks, and they were interpolated because he finds it difficult to spend his whole time at all the meetings but they would probably have come in more properly a little later on. I think in this morning's proceedings we shall have to adhere to the general summary; and I would remind the delegates that we have a very long programme before us as far as the number of resolutions which we propose to put is concerned, while we have only this morning in which to do it. We have not only to finish the subject with which we are now dealing but we have also to deal with rail joints; and it is absolutely essential that we should finish this morning, because there cannot be an afternoon session, and to

tomorrow, as you know, we shall be engaged in a joint meeting on locomotive sheds. I would therefore ask the delegates, while expressing what they wish to bring out, to do so in the smallest number of words possible.

I should like now to proceed with suggestion II :

It appears desirable, in order to follow up the study of the question, that administrations should classify breakages both for « heavy » and « light » rails in such a way as to give at least the following particulars :

A) Percentage of breakages in the respective portions of the rails covered by and clear of the fishplates.

B) Percentage of fractures according to the appearance of the fracture :

a) Fresh and clean fracture through the whole of the rail section:

- 1) With « silvery oval spot »;
- 2) Without « silvery oval spot ».

b) Fractures, part of which are old and strongly oxidised extending to the outer face of the foot or head of the rail:

- 1) When the oxidised part is in the foot;
- 2) When the oxidised part is in the head.

c) Fractures with strongly oxidised portions not extending to the outer face of the foot or head of the rail.

I should like members to address themselves to this subject with a view of deciding whether it is desirable that we should recommend a form which would give the whole of those particulars. It seems to me that the dividing of the fractures into so many different categories will make the research somewhat complex, and it may be that members here may consider that the dividing of the fractures into so many categories will not give us any



information which will lead to any definite conclusions. If the contrary is your view, of course we should have this return as suggested, but I should like members to let us have their views as to how far the information asked for here is desirable and necessary.

If no one desires to speak on the general question, we will take it item by item :

« II. It appears desirable, in order to follow up the study of the question, that administrations should classify breakages both for « heavy » and « light » rails in such a way as to give at least the following particulars : A) Percentage of breakages in the respective portions of the rails covered by and clear of the fish-plates. »

Is that agreed to?

Mr. Jullien (in French). — I quite agree with these classifications, except there should be a remarks column giving additional information, such as fracture with silvery oval spot, fracture with old portion strongly oxidised. I think that it would be well to state whether the rail is broken into two or more pieces. We sometimes have cases of brittle rails which break into 6, 8, 10 or even 20 pieces.

Mr. Wasiutynski (in French). — Paragraph 2 does not agree with what we have decided at a previous meeting. It is intended here that the administrations should separately classify rail breakages in heavy rails and light rails only, whereas we have agreed to have three categories of rails, light, medium and heavy.

In this way, as regards the weight, I believe that it has been decided to have three categories, the first including rails of less than 40 kgr., the second rails of 40 to 50 kgr., and the third rails of more than 50 kgr. I consider that the dif-

ference between 42.5 and 50 kgr. is not very important.

I ask then that we may deal with three categories of rails.

Mr. Desprets, *Principal Secretary* (in French). — It would be better to introduce in paragraph 2 the weights of the rails and to adopt the American classification : 85, 110 and 140 lb.

Mr. Wasiutynski (in French). — In America very heavy rails are used, while other railways have light rails, medium rails and heavy rails, but in no case are these as heavy. The Americans should realise that it is important for railways in general to have the classification on a lower basis.

The President. — Would it not be rather a pity to introduce a fresh set of categories? We have already decided on the three weights of rails, that is to say the three categories into which the weights of rails will naturally fall. Would it not be better, as has been suggested by the principal Secretary, that those three categories should be adopted for this return as well as the other? That would seem to simplify things very considerably.

Mr. Desprets (in French). — I think that I may reply to Mr. Wasiutynski that there are no 40 kgr. (80 lb.) rails; the German rail is a little more than 40 kgr. while in Belgium we have 40.65 kgr. (82 lb.) rails. It would therefore be better to adopt the weight of 42.5 kgr. (85 lb. per yard).

Mr. Merklen (in French). — We decided in the previous meeting on 42.5 kgr.

Mr. Wasiutynski (in French). — 40 kgr. is a mean between 36 and 46 (72.5 and 93 lb. per yard); there is a risk under

the method given in the paragraph to make errors in classification.

**Mr. Desprets** (in French). — In which category would you place the Belgian 40.65 kgr. (82 lb.) rail?

**Mr. Wasiutynski** (in French). — In the category of heavy rails.

**Mr. Stoika** (in French). — In Roumania we have a 40 kgr. rail on which we may get a maximum axle load of 17 tons.

**The President.** — I think we should be wrong if we instituted a fresh category for this return. I have already put to the meeting those who are in favour, but I have not put to the meeting those who are against adopting the category we already have decided upon for another part of the return. Will those who are against adopting the categories we have already adopted please hold up their hands?

(The proposal to adopt the same divisions and to put the rails into the same three categories as before has been carried.)

I think I ought to have drawn attention to the fact that in the account of our deliberations in the *Daily Journal of the session*, the weights were not put down correctly. It reads, as follows :

Classification of breakages according to the weight of the rail per unit of length; these should fall in three categories, one for heavy rails weighing from 110 to 140 lb. per yard and upwards. The second, including rails from 85 lb. to 105 lb. per yard; and the third, light rails under 85 lb. per yard.

You will see that there is a gap between 105 and 110 which is not covered at all, so the first number should be 106. We had better alter that classification to make it read : « 106 to 140 », for class 1, that

is heavy rails; then 85 to 105, and for light rails, under 85 lb.

**Mr. Desprets** (in French). — There are no 106 lb. rails.

**Mr. Quinquet** (in French). — There may be some in the near future.

**The President.** — We now come to Section II (B), and it is in this section where possibly some reduction in the number of columns may be desirable :

Percentage of fractures according to the appearance of the fracture :

a) Fresh and clean fracture through the whole of the rail section :

- 1) With « silvery oval spot »;
- 2) Without « silvery oval spot ».

b) Fractures, part of which are old and strongly oxidised extending to the outer face of the foot or head of the rail:

- 1) When the oxidised part is in the foot;
- 2) When the oxidised part is in the head.

c) Fractures with strongly oxidised portions not extending to the outer face of the foot or head of the rail.

It would perhaps be interesting, if there are any metallurgists present, if they would tell us whether they attach importance to a return giving the breakages as being with or without silvery oval spots. It is not, I think, a matter which has concerned us very much in this country up to now, and I do not think there has been any attempt to classify breakages into those that have or have not a silvery oval spot. I do not know whether it is thought desirable that that should be returned.

**Mr. Maison** (in French). — When one looks into this matter, the proposed modification giving the nature of the

fractures of rails is much less complicated than it would appear. It consists of giving the total percentage of new fractures and the total percentage of fractures which are not new. In the first category are included fractures with silvery oval spot and those without silvery oval spot. This to me appears quite simple. As regards old fractures, we distinguish between those which are oxidised in the foot of the rail and those which are oxidised in the head of the rail, and finally one separates the fractures with an old highly oxidised portion which does not extend to the exterior surface of the foot or head of the rail.

It appears to me that these subdivisions are quite sufficient and that they should be adhered to; if they are increased there is a risk of complicating the statistics. I would therefore urge that the wording proposed by the reporters be adopted.

Mr. Merklen (in French). — The reason that we have included the silvery oval spot in the classification is because in the United States the number of rails broken through this cause is very large; 20 % according to what Mr. Cushing says in his report.

For a number of railways, this means that a new factor has to be taken into account. If these spots have not always been noticed, it is probably due to lack of observation.

I agree with Mr. Maison when he says that we should not further complicate the classification.

Mr. Willem (in French). — A number of administrations have reported transverse fractures with silvery spots, and it is for this reason that in paragraph III we state that it is desirable that the administrations should take, either

on their own or in collaboration with the steel makers, the necessary steps to proceed with an examination of the initial causes of rail breakages.

In accordance with information received, these cases are frequent and therefore it is of interest to have them reported.

Mr. Wasiutynski (in French). — I agree with the proposal of the reporter. We should not neglect anything which is likely to assist in the investigation of rail breakages.

The President. — The general opinion seems to be that the return asked for is in the main right, and I propose therefore that we take it as a whole, that is to say A and B with its subdivision of fractures old and new, those that are oxidised and those that are not; and fractures where strongly oxidised portions extend to the outer face of the rail, and where they do not. That is to say, we take the return *en bloc* as suggested by the special reporters, with the addition, which I think most delegates will agree with, that there should be a note to say whether the rail is broken in more than one place or not. There is no doubt that the most dangerous fractures are those where the rail is broken into several pieces, and it is certainly desirable that we should have that on the face of the return.

(A show of hands being taken, the motion was carried.)

III. — It appears desirable that the railway systems should take the necessary precautions for proceeding, either on their own account, or in collaboration with the steel works, to an investigation of the initial causes of fracture of rails. In particular, it would appear desirable to study the failures that occur through « transverse fissures », a defect that is known in France by the name of « silvery oval spot » (*tache ovale argentée*) the



primary cause of which is not thoroughly understood.

**The President.** — I do not think this translation is very good. I do not think that transverse fissures are the same defect as silvery spot; I think those are two separate defects.

**Mr. Ray.** — As a matter of information, in America we consider the bright silvery or oval spot and the transverse fissure are one and the same. The bright silvery spot in a freshly fractured rail is merely a transverse fissure which has not yet progressed to the surface of the rail. As soon as it breaks through to the running surface or the edge, it becomes oxidised and turns black; so that the small oval spot is a transverse fissure in its early stages of formation. Sometimes they are very small; we have often found rails where there have been a dozen or more of these bright silvery spots within the length of the rail. They are found by taking a rail that has failed with a transverse fissure, and breaking it up into small parts to find out what the rail contains.

**Mr. Merklen (in French).** — This is the way in which the special reporter has regarded the question, and therefore he considers that the wording is correct.

**Mr. Jullien (in French).** — If I rightly understand it, the silvery oval spot is the consequence of the defect.

**Mr. Merklen (in French).** — I quite agree.

**Mr. Maison (in French).** — Among the causes of rail breakages there is one which, in my opinion, is very important and to which it appears sufficient attention has not been given. The reason I have for mentioning this is to encourage an interchange of opinions.

I wish to speak of the small transverse cracks in the upper surface of the rail, especially in portions of the rail subjected to effects of braking and slipping, which causes the head of the rail to become brittle and lead, as Mr. Jullien has just stated, to the rails being broken into pieces. In fact, with these small fissures one always finds a certain amount of separation which, I need hardly tell you, may cause serious accidents. Sooner or later these cracks occur, and it cannot be denied that they make the head of the rail very brittle. Tests have been carried out on test pieces from the head of the rail and from other parts of the rail section which have shown that the rail head is more brittle than is the remainder of the rail section.

After an accident has occurred, careful tests have been made of the broken fragments of the rails, and these have shown the particular brittleness arising from these small cracks. Impact tests have been made on the broken fragments, and it is found that when the impact is taken on the rolling surface of the rail it does not break, but if the rail is turned round a fracture is produced almost at once, the impact in this case having the effect of opening the cracks. As a result of the accident which took place at Grisolle, one could again be convinced that the small cracks in the upper surface of the rail, which is exposed to the effects of braking and slipping, render the rail especially brittle.

These cracks are dependent upon the way in which the metal has been treated; they are much more likely to be met with in a rail which has a chemical composition tending to produce brittleness, or in a rail which has been subjected to an unsuitable heat treatment.

It would be of interest to exchange our experiences upon this point in order to

determine what is the best heat treatment to be adopted so as to avoid these small transverse cracks. It is also very desirable to detect these cracks in rails in service so that when these are discovered the rails may be replaced as soon as possible.

Upon what basis should replacements be carried out? It is difficult to lay down any definite rules in this respect.

We have to be mainly guided by practical experience. It appears to me, however, that when it is found that there are certain parts of the line subjected to the effects of braking and slipping, and that breakages frequently occur as a result of the large number of cracks which develop in the rails, one should commence to remove rails of the same make which have been used under similar conditions.

It is therefore, in my opinion, very important that the administrations should try to discover the presence of transverse cracks in rails in service, and for this reason I think one might add in paragraph III, after the words « the primary cause of which is not thoroughly understood » the words « and also those due to cracks in the upper surface of the rail resulting from the effects of passing trains ».

Mr. Merklen (in French). — What Mr. Maisson has just said is quite correct. In the section of the rail, brittleness is most pronounced in the head and is less so in the web and in the foot; the same being true in the case of new rails — the micrograph shows that the crystals which are large in the head of the rail become smaller and smaller in the web and foot. Therefore it is not the same surface cracks which cause the rails to be brittle; this brittleness exists when the metal is in its original condition. Attempts have been made in France to overcome this brittleness in the head by a partial heat

treatment, which gives very encouraging results.

Mr. Jullien (in French). — As Mr. Maisson has said, an investigation of the superficial cracks which develop in rails as a result of the action of passing trains, brake applications and slipping of engines, is very interesting. I consider that the rail which is affected by segregation or piping is more likely to break than other rails, but one should also take steps as far as possible to avoid slipping.

I might quote a case: on the Orleans Railway there are certain points on the line at which engines are liable to slip, at these places the rails break, and we have to replace them at fairly frequent intervals. What steps have we taken? We have employed heavier engines and there have been no more rail breakages, as the result of there being less slipping.

Slipping has this very undesirable effect, it is that the rail instead of breaking into two pieces, breaks in a large number of pieces, and it is this type of failure which causes serious accidents.

Our Company has also tried methods of detecting these cracks. It has been found that one can grind the rails by means of a carborundum wheel. We have tested the hardness of the metal on the upper surface of the rail by means of a portable Brinell instrument.

We have found that the metal in the upper surface of the rail becomes very hard (120 kgr., in place of 65).

However, if the metal becomes harder, it loses its elasticity. Under bending action, superficial cracks are formed, which tend to spread into the interior of the rail and finally cause a fracture.

The chief difficulty is to know when the crack has become dangerous.

I should be interested to know if my colleagues have found any method for

overcoming this trouble, in any case it is most desirable that the Congress should express an opinion on the utility of investigating this question.

The President. — I think we are all in accord on this subject. It is a somewhat mysterious form of defect, and it is undoubtedly worthy of study. It is suggested therefore that No. III should be agreed to, with this addition: « also the study of rails showing fine cracks across the rolling surface of the rail ».

Mr. Descubes (in French). — I ask that at the beginning of this paragraph the word « continuing » should be used instead of the word « proceeding », seeing that in the United States this question is already under investigation.

I also support the addition proposed by Mr. Maison, because I think it is very necessary to draw the attention of the railways to the little cracks or fissures in the upper surface of the rail. (*Hear!*)

Mr. Merklen (in French). — If we had not mentioned this in our report, it is because we have considered that it is not an initial cause, but a secondary cause.

I agree with Mr. Jullien when he says that these cracks arise from two causes, slipping and brake applications. Slipping produces self hardness.

The discovery of the phenomenon of self hardening in rails was made by Osmond, the great French scientist, to whom Mr. Frémont has paid a tribute by dedicating to him his memoir dealing specially with surface cracks; it contains some very interesting photographs on this subject.

The President. — The section appears to be in agreement as regards adopting

the alterations proposed by Mr. Descubes and the addition proposed by Mr. Maison. (*Agreed.*)

— Paragraph III as thus amended was adopted.

IV. — The segregation found in the metal of the greater number of fractured rails appears to be the most frequent primary cause of the fractures observed; the attention of steel makers should be directed to the necessity for continuing to endeavour to secure the total elimination of segregation of the metal, and it is necessary that provision should be made against segregation by suitable requirements laid down in the specification.

Mr. Ray. — As a matter of information, I would like to say that about four years ago we decided to make a trial with somewhat higher manganese and lower carbon, with a view of getting away from the trouble which we were having from broken rails, with the high carbon steel; with the result that in the fall of 1920 we had rolled about fourteen heats of high manganese steel. I do not mean the manganese steel with 12 to 13 % of manganese, but with manganese ranging between 1.20 % and 1.50 % and carbon around 0.60. These rails were placed in the track in the latter part of 1920. They were 105 lb. section, 6 inches high. The rails gave very good results. We have found that as a rule brittle steel will be detected under our heavy traffic in less than five years, so that a rail which will stand up for a period of four or five years without showing serious defects is pretty apt to run out its life without very serious trouble. On account of this rail showing up as well as it did, in the fall of 1924 we decided to change our specification on all of our contracts, and had



our rails rolled for this present year with manganese ranging between 1.20 and 1.50, and in fact we secured, for experimental purposes, some of the rail with manganese running up as high as 1.70. The carbons were as a rule kept between 0.60 and 0.65. This rail, which was rolled of 130 lb. A. R. E. A. section, gave excellent results both in the rolling and under the tests. The rail showed very few surface defects, the total number of 2nds amounting to less than 4 %, and the requirements under the tests, which were severe, showed that the rail was very tough. We expect good results. Of the fourteen heats which were rolled in 1920, we have only had two failures to date; that is, there are only two rails which have been removed from the track. They showed no unusual signs. One was a straight break without sign of flaw, and the other was a split head. The results were so encouraging that I thought it well worth while to mention the fact.

**Mr. C. P. Sandberg**, Siamese Government. — Mr. Ray has made a very important pronouncement as to the results which he has obtained on his railway with the lower carbon and higher manganese steel. We have all suffered so much from the high carbons when a really hard rail has been required, that from a metallurgical point of view it has always seemed to us extraordinary that greater hardness has been specified to be obtained by a segregating element, carbon, while manganese does not segregate. It segregates less than any of the elements, and therefore with large ingots which increase segregation, I would like to prophesy that a change to higher manganese will be made; and I would also like to congratulate Mr. Ray on having developed a new composition.

Standard specifications are all very well, but they must not remain standard too long if improvements can be introduced in a practical way. I would like to mention our experience in using high manganese and lower carbon in rolling very difficult tram rail sections some years ago. The effect of the manganese, as Mr. Ray points out, is to obtain very clean rolling, and that after all is not only good for the manufacturer in getting fewer flaws, but it is most important to railways when using hard rails to have as few small rolling defects as possible, some of which undoubtedly are passed by the inspectors owing to the mill scale being still on the rails when inspection takes place. I think Mr. Ray has certainly brought forward a most important point, and the railway world in general ought to congratulate him, and look forward to his further experiences on this new quality of rail.

**Mr. Merklen** (in French). — Mr. Cushing has stated in his report « that the elastic limit of the manganese steels tested have not been raised and consequently the resistance offered by the ends of the rails to hammering action was not sufficient »:

He has apparently had, for this reason, trouble to which the attention of metallurgists should be called.

It may be added that steel with a high manganese content is liable to piping: the piping may extend towards the bottom of the ingot; and to obtain satisfactory results, it appears that the ingot should be cast in an inverted position with an adequate sink head.

**Mr. Ray.** — In answer to that point, permit me to say that in one rolling of about 6 600 t. of 130 lb. rail, we discovered only two pipes in the entire rolling, and every ingot was examined in at least

six or eight heats of that rolling. We were told four years ago, when we first undertook these higher manganese steels, that we would get into great difficulty from piping. In fact we found only one manufacturer who was willing to undertake to roll the rail. This particular concern was glad to try it, because we had experimented with them with various kinds of steel, and we were glad to find that we did not have trouble from piping at all. We have had less difficulty, I may say, and considerably less trouble than we had with the high-carbon steel.

**Mr. C. P. Sandberg.** — May I add one word. I feel sure that many railways would like to make their own tests and experiments in connection with this higher manganese percentage and lower carbon from which Mr. Ray has already obtained good results, both as regards tests and in the road; but I would like to warn railways at the present time not to attempt to combine high carbon with high manganese, or they will fail disastrously, in the same way as high carbon and high phosphorus will not go together. Therefore, if you are going to make any experiments with high manganese, reduce your carbons. Mr. Ray did not mention that when we over here talk about 0.60 % carbon, that is rather a high carbon, but in America 0.60 % carbon is under present conditions relatively low carbon. Mr. Ray's railway, or other railways, may have had other rails of 0.85 % carbon. Therefore the reduction of 0.25 % of carbon can be compensated for by the other hardening element, manganese.

**Mr. Merklen (in French).** — Mr. Ray confirms the fact that the steel works have anticipated great difficulty by reason

of piping in manganese steel. Would he tell us if the tests to which he refers were carried out with inverted ingot moulds with a sink head or with ordinary ingot moulds.

**Mr. Ray.** — In the ordinary mould used in the mill.

**The President.** — I am sure that we are all very much obliged to Mr. Ray for bringing forward his experience with — I will not call them manganese steel rails, because they are not, but they are rails with a higher proportion of manganese than is usual for the ordinary open hearth or basic steel method. At the same time I do not think we need carry forward the discussion on special steels any further, because it is obvious that for many years we shall have the ordinary Martin or Bessemer rail steel, and it is also obvious that as long as we have that steel we must seek to eliminate segregation, as far as we can; and all that this paragraph says is that we should endeavour to secure from the makers sound ingots without segregation. That is a pious hope with which I am sure we shall all agree.

— Paragraph IV was adopted.

**V.** — Macrographic tests tend to facilitate examination for segregation. It would be desirable to extend the use of such tests, and improve them, so as to make them of practical service in the inspection of rails. The same remark applies to tests on resilience.

This is the point upon which Sir Henry Fowler addressed us at the opening of the meeting. Would anyone like to speak upon this subject? You will remember that Sir Henry Fowler's view was that sulphur prints was a simpler method than that described in this paragraph, and gave better results.

**Mr. Merklen** (in French). — We have said in our report that :

In order that it may give useful results, the macrographic examination should be carried out on the metal itself, for example by the iodine reaction, and not on bromide paper prints (Baumann tests), obtained by contact with the metal. The latter do not always show the existence of extremely fine cracks running from one impurity to another, cracks that are only rendered visible on the metal itself by the use of high magnification.

The Baumann test, moreover, does not show the different variations in the metal that may exist in a particular section of rail, but which, on the other hand, appear extremely clearly, on metal treated by the iodine reaction.

We recognise, however, that the action on the sensitised paper is more rapid and appears to be suitable for macrographs to be taken at the steel works during the course of manufacture.

However, the iodine reaction is to be recommended for an analytical examination of rail breakages.

Our opinion is based on the very perfect results given in Mr. Fremont's Memoires and from those appearing in our report.

— Paragraph V was adopted.

VI. — The heat treatment of rails appears to have the effect of improving the quality of the metal and reduces its brittleness. It would be of interest to follow up the experiments made with heat treated rails.

This paragraph was adopted with the addition as follows : « ... which have given encouraging results in the United States and in France. »

VII. — Among the secondary causes of rail breakages, the most important must be considered to be shocks produced at

the joints by the rolling loads. It is advisable therefore :

A) On the one hand to increase the length of rails so as to reduce the number of joints, and

B) On the other hand to improve the design of joints so as to suppress or reduce the shocks caused by the passage of the wheels.

**Mr. Ferreira**, Portuguese Railway Company (in French). — I am not sure that we should in the first place mention shocks produced at the rail joints under the effect of the rolling load among the secondary causes of rail breakages.

I consider that there is another cause which is perhaps less frequent, but which has equally serious results, this being the flats which are produced on the tyres. This cause does not depend upon the rails, but upon the condition of the rolling stock, which two elements are very closely connected and should not be dealt with separately.

On our mountainous lines, where there are a number of very heavy gradients, flats are very frequently formed on the wheels, either as a result of very severe brake applications or as the result of defective steel for the tyres.

However, it has frequently been found on the very heavy gradients that the rails break for several hundred metres.

Investigations have nearly always shown that these breakages were not due to cracks in the rails, but to shocks produced by the wheels of passing trains.

I propose therefore to add, to the resolution, that it is advisable to ensure, by frequent examination of the tyres of rolling stock, that no flats are formed which may cause rail breakages.

**Mr. Cambournac** (in French). — I agree with the remarks which have just been put forward, but I think it would



be better to include these in paragraph VIII.

Paragraph VII contains recommendations as regards the upkeep of the track and the length of the rails in order to reduce the number of joints, to improve the construction of the joints in order to minimise the shocks due to passing wheels. However, the recommendations put forward by Mr. Ferreira refer rather to the rolling stock, which is dealt with in paragraph VIII.

**The President.** — We will deal with that on paragraph VIII. There is one point on paragraph VII which seems to me to need a little bit of clearing up. Sub-paragraph A says : « On the one hand to increase the length of rails ». In this country we have got up to 60 foot rails, and on the Nord in France, and perhaps on some other railways, they have got to 18 m. I very much doubt whether it is a practical policy to increase the length beyond these limits. Perhaps some delegates may have other views. If so, we would like to hear them : but so far as I can see the limits of 60 feet and 18 m. are coming pretty near the limit to which we can go.

**Mr. Jullien (in French).** — On the Paris-Orleans Railway we have rails up to 22 m. (72 ft. 2 1/8 in.) in length.

**Mr. Lutton, French State Railways (in French).** — We have on our system 22 metre rails which prove satisfactory.

**Mr. Couvreur, Midi Railway, France (in French).** — The same is the case on the Midi Railway, the wide spaces between the ends of the rails have not given us any trouble.

**Mr. Willem (in French).** — This question of the length of rails comes up for discussion at every session of the

Congress. Formerly, when rails were 9 m. (29 ft. 6 3/8 in.) in length, a length of 12 m. (39 ft. 4 1/2 in.) was recommended; when this limit had been reached, 18 m. (59 ft. 5/8 in.) was adopted, and now we are discussing rails of 22 m. (72 ft. 2 1/8 in.).

It appears to me undesirable to re-open this question in connection with the paragraph which we are discussing.

**The President.** — I withdraw my objection, because it is obvious that from the point of view of the reduction of the number of joints, the longer you can get your rail the better. Therefore, it is for each company, I think, to decide the length of rail they can handle.

— Paragraph VII was adopted.

**VIII.** — It appears possible to prevent to some extent breakages in rails by very careful maintenance of the track and the exercise of close inspection of the material forming it, so as to enable rails to be removed as soon as they begin to develop flaws, which may result, before long, in breakages.

**Mr. Maison (in French).** — I agree with Messrs. Ferreira and Cambournac that among the secondary causes of rail breakages we should include in the first place shocks due to flats on the tyres of the wheels.

However, one might also add that the rail is exposed to severe stress from the hammer blow produced by badly balanced engines. An engine which is not properly balanced in a vertical direction may, in fact, produce very heavy stresses on the rail and cause breakages. Generally speaking, it is advisable to state that careful attention should be given to the proper maintenance of rolling stock. I think, moreover, that it would be as well to delete in the first part of para-

graph VIII the words « to some extent », as in this way our recommendation would have a more general application. If this is agreed to, we could insert in the text : « that it is possible to prevent rail breakages by maintaining the tyres of rolling stock in a good condition ».

**Mr. Jullien** (in French). — Mr. Cushing has drawn attention to a fact which shows the influence of the rolling stock on rail breakages, namely, that the number of breakages on curves of small radius is greater than on curves of large radius, because in the first case the weight on the inner rail is appreciably higher than on the outer rail.

**Mr. Despretz** (in French). — Do you not think that in this case the increased stress in the rail is due rather to lateral reactions than to unequal vertical loads resulting from insufficient superelevation. It appears to me that in most cases the necessarily imperfect balancing of locomotives cannot have as important a vertical effect on the rail as is sometimes attributed to it.

**Mr. Jullien** (in French). — In any case the effect mentioned by Mr. Cushing to which I have just drawn attention is undeniable. On curves of small radius more breakages occur than on curves of large radius.

**Mr. Quinquet** (in French). — I will give you some information which shows how flats on engine wheels may prove detrimental to the track.

About 20 years ago on a line through mountainous country where at certain places the gradient was as much as 1 in 40, the tyre of an engine wheel of 1.3 m. (4 ft. 3 in.) in diameter developed a very bad flat.

After this engine has been used, making an outward and return journey over the same line, it was found that there were 235 rails totally broken, 397 rails partially broken and that 1 200 rails had to be taken up which were only fit for use on sidings.

The damage was produced on the left hand side when ascending inclines. One was forced to conclude that there was a flat on one of the left hand wheels of the engine, but the damage was such that the question was raised whether the influence of the flat had been aggravated by the effect on the left hand rail of engines of this type, in which the left hand crank is fixed at 90° in advance of the right hand crank.

This opinion appeared to be confirmed by enquiries made as regards similar trouble on other railways. In the course of this enquiry, we were advised that a similar experience had been obtained in Mexico, the damage being done on the right hand side when ascending inclines. However, the Mexican engines which had caused the trouble, unlike our engines, had the right hand crank fixed 90° in advance of the left hand crank.

This is an interesting point which may draw the attention to the necessity of having the engines in good condition.

**Mr. Wasitynski** (in French). — Among the causes of rail breakages we should certainly mention those due to the faulty construction of rolling stock, engines and wagons, therefore I think it would be more accurate to say : « reducing by suitable means the dynamic effect of the wheels arising from their condition and from the design of rolling stock ».

In fact, it is not only flats which may cause rail breakages, but there is also the case of badly balanced wheels and an excessive load on the springs.

Mr. Marié has dealt at length in his articles on the oscillation of rolling stock. I think we should mention in paragraph VIII these dynamic effects of the wheels, which no doubt often cause rail breakages.

Mr. Maison (in French). — I agree with Mr. Wasiutynski on the importance to be attached to this cause. It is quite certain that defects in the construction of a locomotive may have an influence on the reaction on the rail and give rise to rail breakages. However, I think that locomotive design should be considered, not only with a view to avoiding the hammer blow on the rails, but also in order to obtain a well balanced engine, without which high speed running is impossible.

I think that we should retain the point put forward by Mr. Ferreira that it is of the utmost importance to pay attention to the defects in rolling stock and their effect on the track.

This is a difficulty which is always present. In the case of locomotives, if it is known to be a bad design, one refuses to allow it to run over certain lines. However, even if it is well designed, it does not necessarily follow that it will not set up heavy stresses in the track if it is in a bad state of repair. We should therefore only mention in paragraph VIII the question of the condition of tyres and rolling stock.

The President. — Gentlemen, we must get on. I am not sure that I agree entirely with Mr. Maison, because recent tests made in this country in connection with bridge stresses have shown that there are numbers of locomotives running about which produce very heavy hammer blows indeed, and I have not the slightest doubt that those hammer blows contribute to rail breakages. It seems to me, therefore, that it would be quite proper to introduce

into this paragraph at any rate a warning note as to the possible bad effect of the condition of the rolling stock tyres, and the hammer blow in locomotives. I will give you what I suggest : « It appears possible to reduce rail breakages by very careful maintenance of the track and the exercise of close inspection of the material forming it, so as to enable rails to be removed as soon as they begin to develop flaws which may result, before long, in breakages. Particular attention must also be paid to the balance of locomotives and the condition of all tyres. »

Mr. Desprets (in French). — I might say that we could discuss for a very long time the question of the effect of balancing of engines on bridges. It should be noted that the present day practice is to use in the calculation of railway bridges an impact factor <sup>(1)</sup> which covers both the sudden application of the load and also the secondary forces produced by the locomotive. These secondary forces also have their effect on the track, but it appears to me that the most important effects as regards rail breakages are the shocks due to flats on wheels and to their faulty state of repair. I am of the opinion that the wording proposed by the President might be adopted, as it appears to be satisfactory to everybody.

Mr. Maison. — I agree.

Mr. Cambournac (in French). — We have heard with very great interest the information given by Mr. Willem as regards the research carried out by the Japanese, and I think it would be well to allude to this in the final summary by saying, for example : « It would be desirable to investigate apparatus whereby

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(1) See American Rules and German Rules for the calculation of steel bridges.



defects may be detected in rails in place in the track. »

**Mr. Maison** (in French). — Quite so, but it must be understood that we should also draw attention to the necessity of efficiently balancing engines and keeping the tyres in a good state of repair.

**Mr. Stoika** (in French). — Allow me to draw attention to the question of axle loads on the various railways. We have found in Roumania that the majority of rail breakages have been caused by too heavy axle loads. It appears to me advisable to recommend that the administrations shall not exceed certain limits.

**Mr. Ruffieux** (in French). — The French text says : « It seems possible to reduce the number of breakages in rails ». I think that that is rather too general, and it would be better to say : « certain kinds of breakages in rails ».

**The President.** — This is a matter which the French delegates must settle amongst themselves. We cannot possibly hope to contribute anything useful to that discussion.

It is suggested that we should leave this paragraph as it stands, with the words « It appears possible to prevent to some extent breakages in rails », and so on.

**Mr. Wasiutynski** (in French). — From the discussion which has just taken place, it would seem that the meeting does not wish to mention the axle load. This is, however, a very important point for railways which use light rails. The table which gives the number of broken rails and the causes should also give an idea of the loads which are carried. An excessive load for the weight of the rail is one of the principal causes of rail breakages. It would be necessary to give the max-

imum loads and the ratio of average weight of rail to average load.

**Mr. Desprets** (in French). — It has been agreed to complete the table by a remarks column in which one can give the maximum axle load over the portion of track in question.

— Paragraph VIII was adopted with the following wording :

« It appears possible to reduce the number of breakages in rails by very careful maintenance of the track and the exercise of close inspection of the material forming it, so as to enable rails to be removed as soon as they begin to develop flaws which may result, before long, in breakages.

It would be advisable to study the question of adequate apparatus for detecting these flaws; particular attention should also be paid to the balancing of locomotives, and the condition of all tyres. »

**The President.** — We have now finished the discussion on the first part of question II. We will therefore proceed to the discussion on the second part of this question, namely, « Rail joints ».

#### B) RAIL JOINTS.

**M. Merklen, Special Reporter** (in French). — As has been already said, the most important secondary cause of rail breakages arises from the construction or state of repair of the rail joints; I think that I should in this connection mention the conclusion of my summary of Mr. Cushing's report.

Having noticed that on the New York Central the proportion of the defects in the portion enclosed by the fish-plate is very small (one defect at the fish-plate for thirty defects in other portions of the rail) Mr. Cushing points out that this low

proportion is attributable to the use of fish-plates 38 inches long carried by three sleepers, one of which is beneath the joint.

This fact is one which should be remembered, the more so since it refers to a type of fish-plate which dates from 1884, and it will be found in the book *Das Eisenbahn Geleise* by Haarmann, which shows this type of joint on page 251 of the first volume. It may induce the railways to revert to the supported type of joint. Our distinguished colleague, Mr. Brown, has given the following opinion on this point :

The supported type of joint is only admissible, provided that it distributes equally between the sleepers on either side of the joint the effects of rolling loads which pass over the joints.

The supported joint of the New York Central appears to fulfil these conditions.

The following is the final summary and recommendations dealing with this question :

1) Joints as presently constructed form the weakest part of the track and there is scope for improvement in the design, always bearing in mind that they should be composed of few pieces, be as simple as possible, cheap to instal and economical to maintain.

2) It would be advantageous to carry out on all administrations simultaneously tests of a certain number of joints which would appear to give better results particularly :

a) Bridge joints, in which the ends of the rails rest on a metal bridging piece between the sleepers on each side of the joint;

b) Suspended joints, in which the sleepers on each side of the joint are brought close to each other;

c) Joints in which holes in the web of the rail are not required.

3) The attention of engineers is directed to the very great interest which would attach to the design of a joint in which the holes in the web of the rail are not required and which would tend to eliminate a considerable proportion of the most frequent form of rail breakage.

4) Means for stopping creep of rails should be provided independently of the joints.

5) The standard length of rails should be increased as far as possible so as to reduce the number of joints.

6) The annual lubrication of fish-plates is to be recommended. The parts should be removed so as to facilitate the examination of the end of the rail covered by the plates.

7) It is important to use, in the manufacture of fish-plates metal free from segregation and other defects.

8) The heat treatment of fish-plates is to be recommended. Any abnormal hardness which may have been produced in the plates is thereby removed.

9) The re-forming of the fish-plates by re-forging when hot may be recommended for the sake of economy.

Mr. L. W. R. Robertson, *Secretary*, read Mr. Cushing's summary.

Messrs. Brown and Willem also read their summaries.

— These summaries are published in the June 1925 number of the *Railway Congress Bulletin*.

The President. — I propose to deal at once with the final summary. (*Agreed.*)

« 1) Joints as presently constructed form the weakest part of the track and there is scope for improvement in the design, always bearing in mind that they should be composed of few pieces, be as

simple as possible, cheap to instal, and economical to maintain. »

— Adopted.

« 2) It would be advantageous to carry out *on all administrations simultaneously* tests of a certain number of joints which would appear to give better results, particularly :

a) Bridge joints, in which the ends of the rails rest on a metal bridging piece between the sleepers on each side of the joint;

b) Suspended joints, in which the sleepers on each side of the joint are brought close to each other;

c) Joints in which holes in the web of the rail are not required. »

Mr. Wasiutynski (in French). — This appears to especially recommend bridge type joints. I consider that these are the least desirable type, and I might even say that they are undesirable. The principal disadvantage which they have is that when the ends of the rails are laid on one bridge type fish-plate there is a difference between the height of the two rails, whereas it is important that these should always be kept level.

The suspended joints on two sleepers close together are, from all points of view, much more satisfactory, and this should be mentioned under paragraph *a*.

As the result of observations on the deformation of the track described in my note presented to the sixth session of the Congress (Paris 1900, question IX, pages 141 to 236 of the Proceedings), we have employed suspended joints on two sleepers in contact over 250 km. (150 miles) of the main line from Varsovie to Kalisz of the Polish Railway. They have been in use for 25 years and have been very satisfactory.

Mr. Merklen (in French). — I do not see any objection, if Mr. Wasiutynski wishes to put the suspended joints in paragraph *a*, I might say that we have put the joints without any hole in the web of the rail under paragraph *c*, although these joints appear to be equally interesting.

Encouraging tests have been carried out in France. As it is important to reduce, as far as possible, chances of rail breakages at the joints, we have considered that we ought to include those which have been mentioned in Mr. Cushing's report, and which, according to him, give complete satisfaction, not only as regards reducing the number of breakages, but also in that they contribute to easy running.

Mr. Brown. — On the London & North Eastern Railway, we have a number of miles of bridge joints, that is to say joints in which the rails on either side of the gap are supported by a metal piece connecting the adjacent chairs; and they have given satisfaction. The running is very smooth, there is no trouble with regard to the inequality of the depth of the rails, and, while there are a certain number of breakages owing to one sleeper becoming slacker than the other, that can easily be got over by careful maintenance. On the whole, we are very satisfied with these joints, but unfortunately they are rather expensive, which is a drawback to their general adoption.

Mr. Couvreur (in French). — On the Midi Railway we employ bridge type fish-plates, and these are quite satisfactory; we not only do not intend to abandon their use, but are not using any others.

Mr. Wasiutynski (in French). — Bridge type fish-plates are another matter. We have the « Fisher » type joint used in America and which has been used for 30 years on some Central European railways where it has proved satisfactory.



Mr. F. S. Hughes, Bengal-Nagpur Railway, British India. — I should like to say a few words in favour of the short bearing fish-plate. With the permission of the President, I have placed before you a model of a fish joint designed by one of the engineers of the Bengal-Nagpur Railway of India, which should be of special interest to those of you who are in favour of the suspended joint.

In this fish-plate the bearing planes have been reduced in length to the minimum required efficiently to grip and keep in register the adjacent ends of the rails. The fishing planes are in contact with each rail for  $3\frac{1}{2}$  inches only. Beyond this short distance, the fish-plate, is not in contact with the rail, which is therefore free to take up curves of deflection as a continuous girder. The metal at the ends of the ordinary fish-plate, which is not only superfluous but which also hinders the rail from flexing as it should, has been removed and placed in the centre, where it is needed. This fish-plate has been tried for a considerable period on the section of the Bengal-Nagpur Railway where the traffic is heaviest, and has given such satisfactory results that we feel justified in adopting it as our standard for new line with heavy traffic. We find that the ends of the rails remain in register, the running is good with practically no shock at the joint, and the bolts remain tight. In addition, the wear on the fishing surfaces is much less than with the standard 4-hole plate. The joint bolts are of a larger diameter than the standard ones, and can be pulled up more tightly without there being any fear of the joint seizing, for two reasons: the first is that there is only one bolt pressing the fishing surfaces together at the end of each rail, and the second is that the

fishing planes of the fish-plates are machined so that the irregularities of the drop forged and rolled surface cannot get interlocked. I have also had a full sized joint cut through for your inspection, and it shows the very substantial nature of the centre portion. The pamphlets beside the joints give technical reasons for the adoption of the short bearing fish-plate.

**The President.** — The fish-plate which Mr. Hughes has described to you is of very great interest. We have quite a number of these fish-plates on the London Midland & Scottish Railway, and so far they have been entirely satisfactory so far as holding the ends of the rails in register and giving a smooth running surface are concerned. One point on which we are not yet satisfied is as to the wear. The fishing surfaces are very much smaller than on the ordinary type of fish-plate, and the experience we have had is that they wear very quickly. On the Bengal-Nagpur Railway the experience is on a much more extensive scale, and I should imagine that the temperature differences are much greater there; so there is probably experience of greater value than ours. I do not see that we need alter anything on paragraph 2, because this would come under the head of a suspended joint, and paragraph *b* suggests that further experiments should be made with suspended joints of all sorts.

**The President** proposed to proceed to a discussion on paragraph 3.

« 3) The attention of engineers is directed to the very great interest which would attach to the design of a joint in which the holes in the web of the rail are not required and which would tend to eliminate a considerable proportion of

the most frequent form of rail breakage. »

— Adopted.

« 4) Means for stopping creep of rails should be provided independently of the joints. »

— Adopted.

« 5) The standard length of rails should be increased as far as possible so as to reduce the number of joints. »

— Adopted.

« 6) The annual lubrication of fish-plates is to be recommended. The parts should be removed so as to facilitate the examination of the end of the rail covered by the plates. »

**The President.** — The only doubt I have in my mind is whether the word « annual » is right. It is not our practice to do it annually: we do it every two years. On some railways I believe they do it annually, but whether it is necessary to stipulate that it should be done annually I rather doubt.

**Mr. Wasiutynski.** — I suggest that we use the word « periodical » which would not imply « annual ».

**The President.** — Yes, I think « periodical » would be better. If no one objects to the word « periodical » we will substitute that word for the word « annual ».

— Paragraph 6 was adopted with this modification.

« 7) It is important to use, in the manufacture of fish-plates metal free from segregation and other defects. »

**Mr. Wasiutynski** (in French). — I think that this clause is too general.

To say that the metal should be sound is not sufficient; it should state whether the metal is to be hard or soft.

If we cannot give any information as regards the quality of the metal to be used, it would be better to delete paragraph 7.

**Mr. Cambournac, Reporter** (in French).

— It has been very difficult to specify the metal, because the practice of the various railways differs. We see that in America they use for fish-plates crop ends which have been cut from the ingots used for making rails because this enables these crop ends to be used up.

What we want to make clear is the necessity of using for fish-plates metal which will resist shock and is free from segregation, whereas it is common practice to use for fish-plates any metal which has been cut off the ingot and which is liable to segregation.

**The President.** — I think we are in agreement that something ought to be said. It is obvious that if you are going to use crop ends, you must use good crop ends, and that they should be free from segregation as far as possible. I do not think there can be any harm in saying that the metal used for fish-plates should be as far as possible free from segregation. That seems to me to be self-evident; so if you raise no further objection we will adopt paragraph 7.

**Mr. Wasiutynski** (in French). — Then paragraph 7 remains as it is?

**The President.** — Yes.

« 8) The heat treatment of fish-plates is to be recommended. Any abnormal hardness which may have been produced in the plates is thereby removed. »

**Mr. Wasiutynski** (in French). — Although on the one hand we are recom-

mending heat treatment which entails a certain cost, on the other hand it is stated that one can manufacture fish-plates from metal which may contain segregation. (*Cries of No.*)

**Mr. Willem** (in French). — We wish to protest against the present day methods of manufacture.

**Mr. O. F. A. Sandberg** (Chinese Government). — I think the wording suggests that the object of the heat treatment is to reduce hardness whereas the object of heat treatment generally is to increase the hardness, and particularly the elastic limit, while avoiding brittleness.

**Mr. Willem** (in French). — There are two things to consider; the brittleness and the amount of hardness.

**The President.** — You are prepared to agree that heat treatment should be adopted as a general practice?

**Mr. Brown.** — This is a recommendation. It is quite true that in this country it is not adopted, but it is only being experimented with; but I understand that in other countries heat treatment is used with the object of getting rid of brittleness, and it was felt that it was advisable to have a general clause of this nature, so that one could adopt it or not as thought fit.

— Paragraph 8 was adopted.

« 9) The re-forming of the fish-plates by re-forging when hot may be recommended for the sake of economy. »

— Adopted.

**The President.** — Gentlemen, we have now finished the discussion on question II. I thank you for the attention which you have given during the lengthy discussions and for your assistance in rendering the final summary as complete as possible.

The meeting terminated at 1.15 p. m.

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# DISCUSSION AT THE GENERAL MEETING

Meeting held on the 1 July 1925 (afternoon).

PRESIDENT : RIGHT-HON. SIR EVELYN CECIL, VICE-PRESIDENT.

GENERAL SECRETARIES : SIR HENRY FOWLER and Mr. P. GHILAIN.

Sir Henry Fowler, *General Secretary*, read the final summary adopted by the 1st section.

This final summary gave rise to no discussion.

The President. — The final summary is therefore as follows :

## Final summary.

### BREAKING OF RAILS.

« I. — Examination of the replies  
« relating to breakage of rails supplied  
« by the various administrations has been  
« made difficult, and their comparison  
« impossible, on account of the differences  
« in the regulations of the respective  
« administrations under which  
« statistics are drawn up.

« It seems desirable that common  
« regulations dealing with the matter  
« should be adopted on the following  
« lines :

« A) Definition of breakages. — A rail  
« should be considered as broken when  
« completely separated into two or more  
« portions, or when a piece of the head  
« is broken off, causing an interruption  
« of the running surface.

« B) Classification of breakages according  
« to the weight of the rail per  
« unit of length; these should fall into  
« three categories — one for light rails

« weighing under 85 lb. per yard  
« (42.5 kgr. per metre), the second for  
« medium rails 85 lb. to 105 lb. per yard  
« (42.5 to 52.5 kgr. per metre), and the  
« third for heavy rails of 106 to 140 lb.  
« per yard (53 to 70 kgr. per metre) and  
« upwards.

« C) Classification of breakages, according  
« to the age of the rails, in the  
« track, viz., those having less than  
« 5 years, from 5 to 10, from 10 to 15,  
« from 15 to 20, and beyond 20 years.

« D) An index number of the breakages :  
« The total number of breakages,  
« without distinction of weight and age,  
« of the rails, on each administration, in  
« relation to traffic density by giving the  
« number of breakages per 10 000 000  
« km.-trains or 6 250 000 train-miles.

« E) The information to be supplied in  
« the form of the attached table and sent  
« in yearly, before the 31 March of the  
« ensuing year, to the Permanent Commission,  
« who will combine the replies  
« for publication.

« II. — It appears desirable, in order  
« to follow up the study of the question,  
« that administrations should classify  
« breakages for the three categories of  
« rails (the light, medium and heavy) in  
« such a way as to give at least the following  
« particulars :

« A) Percentage of breakages in the

### Age of rails:

Number of fractures per 10 000 000 train-kilometres or	
6 250 000 train-miles . . . . .	

« respective portions of the rails covered  
« by and clear of the fish-plates.

« *B*) Percentage of fractures accord-  
« ing to the appearance of the fracture :

« *a*) Fresh and clean fracture through  
« the whole of the rail section :

« 1) With « silvery oval spot »;

« 2) Without « silvery oval spot ».

« *b*) Fractures, part of which are old  
« and strongly oxidised, extending to the  
« outer face of the foot or head of the  
« rail :

« 1) When the oxidised part is in the  
« foot;

« 2) When the oxidised part is in the  
« head.

« *c*) Fractures with strongly oxidised  
« portions not extending to the outer  
« face of the foot or head of the rail.

« *d*) The number of pieces into which  
« the rail is broken.

« III. — It appears desirable that the  
« railway systems should take the neces-  
« sary precautions for proceeding, either  
« on their own account, or in collabora-  
« tion with the steel works, to an investi-  
« gation of the initial causes of fracture  
« of rails. In particular, it would appear  
« desirable to study the failures that  
« occur through « transverse fissures »,  
« a defect that is known in France by the  
« name of « silvery oval spot » (*tache*  
« *ovale argentée*), the primary cause of  
« which is not thoroughly understood;  
« also the study of fine cracks appearing  
« on the rolling surface of the rails  
« should be continued.

« IV. — The segregation found in the  
« metal of the greater number of fractur-  
« ed rails appears to be the most frequent  
« primary cause of the fractures observ-

« ed; the attention of steel makers should  
« be directed to the necessity for con-  
« tinuing to endeavour to secure the total  
« elimination of segregation of the metal,  
« and it is necessary that provision should  
« be made against segregation by suitable  
« requirements laid down in the specific-  
« ation.

« V. — Macrographic tests tend to  
« facilitate examination for segregation.  
« It would be desirable to extend the use  
« of such tests, and improve them, so as  
« to make them of practical service in the  
« inspection of rails. The same remark  
« applies to tests on resilience.

« VI. — The heat treatment of rails  
« appears to have the effect of improving  
« the quality of the metal and reduces its  
« brittleness. It would be of interest to  
« follow up the experiments made with  
« heat-treated rails, which have given  
« encouraging results in the United States  
« and in France.

« VII. — Among the secondary causes  
« of rail breakages, the most important  
« must be considered to be shocks pro-  
« duced at the joints by the rolling loads.  
« It is advisable, therefore from this  
« point of view :

« *A*) on the one hand, to increase the  
« length of rails so as to reduce the num-  
« ber of joints, and

« *B*) on the other hand, to improve  
« the design of joints so as to suppress  
« or reduce the shocks caused by the  
« passage of the wheels.

« VIII. — It appears possible to reduce  
« the number of breakages in rails by  
« very careful maintenance of the track  
« and the exercise of close inspection of  
« the material forming it, so as to enable  
« rails to be removed as soon as they



« begin to develop flaws which may  
« result, before long, in breakages.

« It would be advisable to study the  
« question of adequate apparatus for  
« detecting these flaws; particular atten-  
« tion should also be paid to the balanc-  
« ing of locomotives, and the condition of  
« all tyres. »

#### RAIL JOINTS.

« 1. — Joints as presently constructed  
« form the weakest part of the track and  
« there is scope for improvement in the  
« design, always bearing in mind that  
« they should be composed of few pieces,  
« be as simple as possible, cheap to instal  
« and economical to maintain.

« 2. — It would be advantageous to  
« carry out *on all administrations simul-*  
« *taneously* tests of a certain number of  
« joints which would appear to give  
« better results, particularly :

« a) Bridge joints, in which the ends  
« of the rails rest on a metal bridging  
« piece between the sleepers on each side  
« of the joint;

« b) Suspended joints, in which the  
« sleepers on each side of the joint are  
« brought close to each other;

« c) Joints in which holes in the web  
« of the rail are not required.

« 3. — The attention of engineers is  
« directed to the very great interest  
« which would attach to the design of a  
« joint in which the holes in the web  
« of the rail are not required and which  
« would tend to eliminate a considerable  
« proportion of the most frequent form  
« of rail breakage.

« 4. — Means for stopping creep of  
« rails should be provided independently  
« of the joints.

« 5. — The standard length of rails  
« should be increased as far as possible  
« so as to reduce the number of joints.

« 6. — The periodical lubrication of  
« fish-plates is to be recommended. The  
« parts should be removed so as to faci-  
« litate the examination of the end of the  
« rail covered by the plates.

« 7. — It is important to use, in the  
« manufacture of fish-plates, metal free  
« from segregation and other defects.

« 8. — The heat treatment of fish-plates  
« is to be recommended. Any abnormal  
« brittleness which may have been pro-  
« duced in the plates is thereby removed.

« 9. — The re-forming of the fish-  
« plates by re-forging when hot may be  
« recommended for the sake of economy.»

— The final summary was ratified by  
the General Meeting.

## QUESTION III.

## SHUNTING YARDS.

*Shunting and marshalling yards for goods trains.**Lay-out and organisation.*

## Preliminary documents.

1st report (all countries, except America, Belgium, France and the British Empire), by Mr. W. SIMON-THOMAS. (See English edition of the *Bulletin*, February 1925, p. 237, and May 1925 (2nd part), p. 2054), or separate issue [with red cover] No. 17.)

2nd report (America), by Mr. S. T. WAGNER. (See English edition of the *Bulletin*, October 1924, p. 793, or separate issue [with red cover] No. 2.)

Supplement to the 2nd report, by Mr. S. T. Wagner. (See English edition of the *Bulletin*, May 1925 [1st part], p. 1619, or

separate issue [with red cover] No. 40.)

3rd report (British Empire), by Mr. R. H. NICHOLLS. (See English edition of the *Bulletin*, November 1924, p. 877, or separate issue [with red cover] No. 4.)

4th report (France and Belgium), by Messrs. MOUTIER and PELLARIN. (See English edition of the *Bulletin*, May 1925 [1st part], p. 1495, or separate issue [with red cover] No. 36.)

Special reporter : Mr. W. SIMON-THOMAS. (See English edition of the *Bulletin*, June 1925, p. 2098.)

## SECTIONAL DISCUSSION

Meeting held on 23 June 1925 (morning).

## SECTIONS I AND III (MEETING JOINTLY).

Mr. DU CASTEL, PRESIDENT OF SECTION III, IN THE CHAIR.

The President (in French). — I have pressed Mr. Trench, president of section 1, to accept the chairmanship of the meeting, but he has expressed the desire that I should collaborate with him in presiding over our deliberations.

We have to discuss the question of shunting yards, and I will now call upon

Mr. Simon-Thomas, the special reporter, to read his report.

Mr. Simon-Thomas the *Special Reporter*, thereupon read the report which appeared at page 2 098 of the *Bulletin* of June 1925.

The President (in French). — In

order to save time. I propose that we take successively the various points contained in the summary, and it will be open to you to make what observations you think fit as the different points are considered. (*Agreed.*)

I will now read point 1.

« 1. — A shunting and marshalling yard, well placed with regard to the railway system, enables traffic to be conducted more rapidly and increases the traffic capacity of the lines.

« The arrangement depends on the organisation of traffic into through, semi-through, and stopping trains, as required by the magnitude and distribution of the traffic.

« These yards are placed at centres in which the traffic is sufficiently dense to necessitate distribution over the different routes. »

**Mr. Pellárin, Reporter** (in French). — I think that the first paragraph as proposed by Mr. Simon-Thomas, does not define sufficiently the principles which should govern the choice of location of a shunting yard.

The special reporter proposes to say :

« A shunting and marshalling yard, well placed with regard to the railway system, enables traffic to be conducted more rapidly and increases the traffic capacity of the lines. » Would it not be better to indicate what constitutes a suitable location for such a yard?

**The President** (in French). — What would you suggest?

**Mr. Pellarin** (in French). — I suggest the following wording :

« In general shunting yards are placed at the starting points of important

traffic routes or at central points of main lines. »

The function of a shunting yard situated at the starting point of an important traffic route is to distribute the traffic for the different directions which it has to take. This would apply, for instance, in the case of dense traffic from a mining district or large industrial area.

Further, a shunting yard should be provided at an extremity of a railway system when a large amount of traffic is received from a neighbouring system to be forwarded in various directions.

**The President** (in French). — Is it necessary, gentlemen, to translate Mr. Pellarin's remarks into English? (*No! No!*)

I now call upon Mr. Lamalle.

**Mr. Lamalle, Belgian State Railways** (in French). — Gentlemen, I wish to support the suggestions put forward by Mr. Pellarin.

I share his opinion that the question of the location of shunting yards is an important one. I would add that if we consider the case of two shunting yards A and B, these yards should be served by collecting trains, and between these two yards there should be a circulation of through trains having as long a journey as possible.

There is another question which does not appear to have been touched upon by the special reporter, Mr. Simon-Thomas, namely the rapid handling of rolling stock. I venture, therefore, to call the attention of the section to the fact that a carefully planned location of shunting yards tends to reduce the time taken in handling goods traffic.

**The President** (in French). — Gentlemen, in order to meet the views of



Mr. Pellarin and Mr. Lamalle I suggest that the first paragraph be worded as follows :

« Shunting and marshalling yards enable traffic to be conducted more rapidly and increase the traffic capacity of the lines. » We will delete the phrase « well placed with regard to the railway system », and carry on with the present third paragraph, which will become the second paragraph : « These yards are placed at centres in which the traffic is sufficiently dense to necessitate distribution over the different sections », and we will add : « especially at communication points ».

Then will follow the present second paragraph :

« The lay-out depends on the organisation of traffic into through, semi-through and stopping trains, as required by the extent and organisation of the traffic. »

We shall thus express the necessity of carefully choosing the location of shunting yards having regard to communication points, and we shall indicate as desired by Mr. Lamalle, that the proper placing of shunting yards facilitates a more rapid handling of traffic. (*Agreed.*)

I will now ask Mr. Simon-Thomas, to read the English translation of this text.

(Mr. Simon-Thomas read the translation.)

Mr. Lamalle (in French). — Would it not be desirable, Mr. President, to add, after the words « increase the traffic capacity of the lines », the words « as well as the effective use of rolling stock »?

The President (in French). — In that case it will read :

« Sorting and marshalling yards enable traffic to be conducted more rapidly and

increase the traffic capacity of the lines as well as the circulation of rolling stock. » (*General agreement.*)

This wording is adopted, as well as the other paragraphs of point 1 amended as indicated above.

Mr. Maison, Ministry of Public Works, France (in French). — I am in agreement with the wording of the first paragraph. As regards the second, which says that « the lay-out depends on the organisation of traffic into through, semi-through and stopping trains as required by the extent and distribution of the traffic », I think that this might be deleted, as in a shunting yard the organisation of through, semi-through and stopping trains has not the importance which appears to be attached to it.

Mr. Moyrand, Northern Railway of France (in French). — I think the point raised by Mr. Maison would be met if we defined the word « disposition » in the French text.

By « disposition » do we mean the site of the yard or the lay-out of the tracks?

If the word « disposition » refers to the manner in which the tracks are laid-out and the general formation of the yard it expresses a concrete idea since, according as a shunting yard is used (in connection with circulation between A and B) for making up through, semi-through, or stopping trains, the arrangement of the tracks will not be the same.

Perhaps the President will explain to us this word « disposition ».

The President (in French). — The English text is clearer. The word there used is « arrangement ».

In order to make the point clear we might say : « la consistance et la disposition dépendent de l'organisation, etc. »

**Mr. Lamalle** (in French). — Or : « le système de gare ».

**The President** (in French). — It appears to me that the explanation of the word « disposition » is to be found in No. 2, which indicates what is contained in shunting yards.

**Mr. Moyrand** (In French). — I consider that the word « aménagement » would be more appropriate. (*General agreement.*)

**The President** (in French). — The meeting adopts, then, the first paragraph; the second paragraph will read as follows: « L'aménagement dépend de l'organisation du trafic en trains directs, semi-directs ou omnibus, commandée par l'importance et l'organisation du trafic. » (*Agreed.*)

The English text is to remain unchanged.

I take it that we are agreed as to the third paragraph. (*General indication of agreement.*)

We now pass to No. 2 which relates to the constitution of shunting yards.

« 2. — They comprise in general arrival sidings, sorting sidings and, fairly frequently, marshallings sidings, sidings for making up according to destination, sidings for trains waiting for departure and transhipment sheds.

« Finally, the installation is completed by a wagon repair section, a locomotive shed and a disinfecting yard.

« The length of such a yard may amount to from 3 to 5 km. (1.8 to 3.1 miles). »

**Mr. Pretorian**, Roumanian State Railways (in French). — I think the third paragraph should follow after the first,

because the latter sets out the elements which constitute shunting yards.

It is not sufficiently precise to say « from 3 to 5 km. » There are some yards which are not 3 km. long, and it would be preferable to say merely : « the length of such a yard may amount to 5 km. (3 miles) ».

**Mr. Moutier**, *Reporter* (in French). — As regards the first paragraph of No. 2, I certainly think it is a mistake not to indicate that the arrival sidings may be identical with the splitting-up sidings, but I do not insist on this point. What I really wish to say has to do with the second paragraph : « The installation is completed by a wagon repair section, a locomotive shed and a disinfecting yard. »

Although I agree that it is necessary that the shunting yard should have a wagon repair shop and a locomotive shed, I do not on the other hand consider it desirable to have a disinfecting yard.

On our railway system we formerly had disinfecting yards in shunting yards and we have abolished them, for cattle are not unloaded in the shunting yards; it is rather at local stations, where cattle arrive in large quantities, that the wagons must be disinfected.

**Mr. Pellarin** (in French). — It would meet the case if we said :

« Finally, the installation may be completed... »

**Mr. Maison** (in French). — Mr. Moutier's remarks are justified by the fact that in France the regulations stipulate that wagons shall be disinfected immediately after use. There would, therefore not be sufficient time to carry out this disinfection in the shunting yards.

**The President** (in French). — I sug-

gest that we say : « Finally the installation is completed by a wagon repair section, a locomotive shed and a disinfecting yard, if required. »

**Mr. Lamalle** (in French). — If necessary.

**Mr. Maison** (in French). — I also wish to make an observation with regard to the first paragraph, which says that shunting yards comprise in general arrival sidings, sorting sidings and, fairly frequently, marshalling sidings, sidings for making up according to destination, sidings for trains waiting for departure and transshipment sheds.

The paragraph is in reality a statement of fact, but this statement of fact does not apply entirely to the situation in all shunting yards. Very frequently there are no sidings for marshalling and making up according to destination, and in this case the sorting sidings must have a greater length so that the marshalling and making up may take place at the end of such sidings. This possibility ought to be provided for in the first paragraph, as follows :

« If there are no sidings for making up according to destination, the sorting sidings must be sufficiently long to permit of the making up operations taking place at one end. »

**The President** (in French). — This point can be considered when we come to the question of the length of shunting sidings.

**Mr. Lamalle** (in French). — The first paragraph of No. 2 reads as follows : « They comprise in general arrival waiting sidings, sorting sidings and, fairly frequently, marshalling sidings, sidings for making up according to destination,

sidings for trains waiting for departure and transshipment sheds. »

I consider, however, that it would be preferable to change the sequence and say : « ... sidings for making up according to destination, marshalling sidings... » because, of course, the making up according to destination precedes the marshalling.

**Mr. Moyrand** (in French). — Gentlemen, I am unable to concur in Mr. Lamalle's remarks as, in our case, « marshalling » comprises the collecting of the sorted wagons and the necessary braking arrangement; the second operation is the division of the wagons according to destination, whether per terminal station or per group of terminal stations. This division according to destination is therefore one of the marshalling operations. We classify first of all according to the line, and then according to destination. The regrouping of wagons according to destination constitutes what we understand by marshalling.

**The President** (in French). — The text as it stands at present does not indicate the order of priority of operations. I think, therefore, that it might stand.

**Mr. Lamalle** (in French). — I do not insist.

**Mr. Pretorian** (in French). — Gentlemen, I propose that we say « arrival sidings » instead of « arrival waiting sidings ». (*Agreed.*)

**The President** (in French). — I think, gentlemen, that having regard to the various observations which have been made during the discussion, we might word No. 2 as follows :

« The length of these stations may amount to 5 km. (3 miles).



« They comprise in general arrival sidings, sorting sidings and, fairly frequently, marshalling sidings, sidings for making up according to destination, sidings for trains waiting for departure and transhipment sheds.

« Finally, the installation is completed by a wagon repair section, a locomotive shed and, if required, a disinfecting yard. »

In the absence of any objections to this wording I shall take it as adopted. (*Agreed.*)

We now come to No. 3.

**Mr. Simon-Thomas, *Special Reporter*,** read the English text of No. 3, as follows:

« 3. — The use of gravitation for shunting may be adopted in shunting yards by constructing these on a continuous gradient or on the level with humps. The first method is only to be recommended in case a natural gradient exists, and when the number of wagons to be shunted does not exceed 5 000 per day.

« An arrangement of shunting yard in which the formation is partially inclined may have advantages, particularly in the case of groups of reception sidings and sidings for sorting according to geographical destination.

« In such a case, however, it is advisable to be able to perform the operations by means of locomotives at times when the atmospheric conditions are unfavourable and the working of the group of sidings by gravity is not satisfactory. »

**Mr. Moutier (in French).** — The text proposed reads : « The first method is only to be recommended in case a natural gradient exists, and when the number of wagons to be shunted does not exceed 5 000 per day ».

The latter condition appears to me very

much open to question. In the first place, there has never been unanimity on the point of the number of wagons, some say 2 000, some 4 000, and others 5 000. It is all a question of opinion. Moreover, the maximum number of wagons which can be dealt with in a yard which is wholly on a gradient may depend on local conditions. I consider, therefore, that it is not advisable to mention any figure in a formula meant for general application. I suggest that we delete the words : « and when the number of wagons to be shunted does not exceed 5 000 per day ».

It is sufficient to say that the first method is only to be recommended in case a natural gradient exists. I might add that I know of only one yard which is on a continuous gradient, namely that at Terre-Noire on the Paris-Lyons-Mediterranean. I do not know of any in Belgium.

**Mr. Lamalle (in French).** — I agree with the view expressed by Mr. Moutier.

**The President (in French).** — We will delete the phrase referred to by Mr. Moutier.

Are there any observations as to the other paragraphs?

**Mr. Lamalle (in French).** — As regards the continuous gradient, the question has arisen as to whether yards should be partially on a gradient, followed by sidings on the level, or whether use should be made of humps.

It would be useful if this point could be discussed, and I should like to give my personal opinion.

I consider that in yards which have humps the output is greater, as the wagons move more quickly and are more rapidly split up than in yards in which the reception sidings are laid out on a

gradient. If, however, one looks at the question from the point of view of the economy effected in the use of shunting engines, it must be recognised that the advantage lies with yards which have reception sidings on a gradient. It would be advisable, therefore, to come to a decision as to which of the two systems is the more economic.

**Mr. Moutier** (in French). — It would be desirable, in any case to alter the wording. The first sentence reads : « The use of gravitation for shunting may be adopted in shunting yards by constructing these on a continuous gradient or on the level with humps ».

As one of our colleagues has pointed out, the text proposed does not cover the case in which the splitting-up sidings are, as on the Northern Railway of France in particular, on a continuous gradient, while the sorting sidings are on the level. The text should provide for such a solution, which is not accidental, but on the contrary systematic; it should therefore state that « the yards can be established either on a continuous gradient with splitting-up sidings worked on the gravitation system, or they may be on the level with humps ».

**Mr. Tettelin**, Northern Railway of France (in French). — The text states that the continuous gradient method is only possible if a natural gradient exists.

**Mr. Moutier** (in French). — The report of one of our American colleagues states that in America it has been found possible to construct a yard on a continuous gradient by building up an artificial slope.

**M. Renard**, Eastern Railway of France (in French). — A clause should be added

to cover Mr. Lamalle's remark relating to the economy which can be effected in the use of shunting engines.

It must not be forgotten that in the case of a yard in which the sidings are on a continuous gradient, it is necessary, if very appreciable difficulties of movement are to be avoided, that the whole train should be run on to the arrival sidings by the entrance opposite the splitting-up sidings. This necessitates the hauling of certain trains for a considerable distance, and the result is that you lose on the engine of the train thus hauled what you gain on the shunting engine. However, as regards the output of the shunting yard, I consider that the continuous gradient has a slight advantage over the hump.

When there is a train to be split up, it may have to be done wagon by wagon; but in some cases batches of three, four, five, or sometimes more wagons can be switched off together on to a single sorting track. Among these batches of several wagons there may be single wagons which must be switched on to other tracks. When the splitting-up is done by means of a hump, the driver of the shunting engine must be able to work at a uniform speed, and this speed must not be too great so that the wagons which have to be switched off singly may be diverted to the different tracks. When it is a case of running batches of four or five wagons on to a single track, the driver cannot regulate his speed accordingly; the result is that when the wagons have left the top of the hump a certain fraction of time elapses during which the power of gravitation does not exercise itself. If there are arrival sidings on a continuous gradient, it is undoubtedly possible, after sending down a batch of four or five wagons, to release a single wagon after an interval of time just sufficiently long

to preclude the possibility of collision or derailment. It is then only necessary to observe the same interval before releasing a further batch. In this way the gravitation potentiality is fully utilised. This is one of the principal advantages, from the point of view of output, of having arrival sidings on a continuous gradient. (*Applause.*)

**Mr. Pellarin (in French).** — Gentlemen, if it is desired to make a comparison between the hump system and the gradient system it must be recognised that in either case the object to be attained is to cause the wagons to run down from a certain height by their own weight. Whether this height is obtained by means of a hump or by means of a continuous gradient, the dynamic result is the same. In the case of the hump, however, it is only necessary to construct this height for one or two tracks, that is to say, the cubic contents of the earthworks are relatively less.

On the other hand, if it is desired to construct the arrival sidings at a higher level than the splitting-up sidings, it is necessary to give the arrival sidings a continuous gradient less steep than that of the hump, but all the same it must be sufficiently steep, so as to give a difference of level of from  $2\frac{1}{2}$  to 3 m. (from 8 ft. 2  $\frac{7}{16}$  in. to 9 ft. 10  $\frac{1}{8}$  in.), according to the nature of the site. If it were desired to establish such a gradient on level ground, the quantity of earthworks to be constructed would be considerable, and it would be necessary in the first place to ascertain whether the cost of installation would be greater or less than the possible economy in shunting engines.

As Mr. Renard has pointed out, it is sometimes necessary for trains to arrive at the opposite end, and this may give rise to complications and to a lengthening of the yard, if recourse is had to a loop.

**The President (in French).** — May I ask you to speak a little louder: it is rather difficult to catch your remarks.

**Mr. Pellarin (in French).** — On the Eastern Railway of France we have had to install shunting yards under somewhat difficult topographical conditions, and we should have found it almost impossible to lay down a loop in view of the nature of the ground.

I think, therefore, that we should not make our paragraph too absolute, and that the prime factor in the choice of system to be adopted is the nature of the locality.

**Mr. Le Besnerais, Northern Railway of France (in French).** — Gentlemen, I am in agreement with what Mr. Pellarin has just said, but I would make just one exception.

Mr. Pellarin has said that the loop lengthens the running. This is correct, but by means of the loop the time taken is reduced, and the important consideration is not the length of the run but the time taken.

The use of a loop has the advantage of reducing the time in two ways: first, because the trains enter direct, and, secondly, because movement in the shunting yard is not interrupted by their entrance.

**Mr. Lamalle (in French).** — Mr. President, Mr. Renard has defended at great length the principle of having the reception sidings on a gradient. I will not attempt to oppose this principle, but I have noticed, when visiting yards constructed on this system that the movements of the brakeman who accompanies the wagons on the gradient are slow. It is first of all necessary to take the brakes off so that the wagons may descend, and then the wagons must be braked again in order to stop them. I believe that wagons are brought more rapidly to the top of



the hump in yards where these are provided.

I would now like to make one remark with regard to what has been said by Mr. Pellarin.

It is necessary, in my opinion, to distinguish two phases in the movement of wagons: the first consists in bringing them to the top of the hump or on to the small dip at the foot of the continuous gradient; the second is the descent of the wagons. And in this respect I am in agreement with Mr. Pellarin, for the speed is obviously dependent on the height of the slope.

**The President** (in French). — Gentlemen, as a result of the discussion which has taken place I think it would be reasonable to propose the following wording for No. 3 :

We will leave the first sentence as it stands;

« From the point of view of the use of gravitation for shunting the yards can be established either on a continuous gradient or on the level with a hump. »

We can then say :

« In the former category are included yards in which the total incline is continuous, and yards partially inclined, particularly in the case of reception sidings and sidings for marshalling according to destination.

« The construction of a yard entirely on a continuous gradient does not appear advisable except in cases where the ground offers a natural slope.

« In the case of yards which are partially on a continuous gradient it is desirable to be able to perform the operations by means of locomotives in cases where, as a result of unfavourable atmospheric conditions, the working of the group of arrival sidings would otherwise not be satisfactory. »

**Mr. Le Besnerais** (in French). — I think that it would be better to substitute the word « chantiers » (sidings) for the word « gares » (yards). In practice there may exist, in one and the same yard, sidings with a hump and sidings with double working.

Mr. Pellarin prepares a wording to meet this point.

**The President** (in French). — Gentlemen, the principle upon which I ask the Section to agree is that there are two types of shunting yards: those with a hump and those on a continuous gradient. With the latter type it is necessary to distinguish between yards entirely on a continuous gradient and yards partially on a continuous gradient.

It is suggested that we use the word « chantiers » (sidings) instead of « gares » (yards), and I think you will probably agree to this.

In this case paragraph 3 will read as follows :

« From the point of view of the use of gravitation for shunting the sidings can be established either on a continuous gradient or on the level with a hump. In the former category are included sidings in which the total incline is continuous, and sidings partially inclined, particularly in the case of reception sidings and those for marshalling according to destination.

« The construction of sidings entirely on a continuous gradient does not appear advisable except in cases where the ground offers a natural slope. »

**Mr. Gaeremynck**, Belgian State Railways (in French). — It does not appear to me that it is sufficient to say that any one yard or type of yard is to be recommended: the point of view adopted should be indicated, as the type of yard preferred will depend on the point of view.

Apart from other considerations, account should be taken of the cost of shunting per wagon. Instead, therefore of saying simply « recommandable » (English text : « advisable »), there should be an indication of the advantages of one type as compared with the other. From the point of view of the initial cost of construction, if there is not a sufficient natural slope, a yard on a continuous gradient sometimes entails greater expense than the cost of engines and labour in a yard with a hump. Precise indications are therefore necessary.

**Mr. Pretorian** (in French). — I suggest the deletion of the third phrase and a modification of the wording of the first, as follows :

« From the point of view of the use of gravitation for shunting, the sidings can be established, according to local conditions and the configuration of the ground, either on a continuous gradient or on the level with a hump. »

**The President** (in French). — The wording suggested by Mr. Pretorian appears to me to be suitable because it meets all possible situations. It might perhaps be completed by the addition of a recommendation clause when the discussion has established the merits of this or the other system.

No. 3 would then read as follows :

« From the point of view of the use of gravitation for shunting, the sidings can be established, according to local conditions and the configuration of the ground, either on a continuous gradient or on the level with a hump. In the former category are included sidings in which the total incline is continuous, and sidings partially inclined, particularly in the case of reception sidings and those for marshalling according to destination. In the

latter case it is desirable to be able to perform the operations by means of locomotives in cases where, as a result of unfavourable atmospheric conditions, the working of the group of arrival sidings is not satisfactory.

« Sidings on a continuous slope do not appear advisable except in cases where the ground offers a natural slope. »

(*Signs of agreement.*)

— I gather that this text is approved.

« 4. — A group of shunting sidings for each direction is necessary if the number of wagons to be shunted per day exceeds the capacity of a single hump. Otherwise, a single group of sidings is to be recommended for both directions of traffic, unless each direction is practically independent of the other.

« In yards, however, which are arranged with a single group of shunting sidings, it is necessary to make provision so that the yard can be enlarged by groups of sidings for both directions of traffic when the traffic has increased. »

**Mr. Payet**, French State Railways (in French). — Point No. 4 begins with the sentence : « A group of shunting sidings for each direction is necessary if the number of wagons to be shunted per day exceeds the capacity of a single hump. »

The shunting may, however, be in a single direction; it is not therefore, an essential condition. The essential condition which necessitates having the two directions is that the traffic shall be independent.

I consider, therefore, that we should say that the two directions for splitting-up are advisable when the traffic in either direction is independent of the other.

**Mr. Henry-Gréard**, Paris-Orleans Railway (in French). — I support Mr. Payet's

remarks. We are, in fact, confusing two ideas between which it is essential to distinguish. In certain cases the two directions of traffic are clearly defined, as for example in the vicinity of a large town. In the latter case the dispatching station receives the wagons from both directions, but by the side of stations of this kind there are others with radiating lines, in which case it would be difficult to distinguish between the two directions of traffic. It does not appear to me to be advisable, therefore, to establish a connection between the capacity of a hump and definition of the direction of traffic. It would meet Mr. Payet's point to say: « A group of shunting sidings for each direction is advisable when it is possible to distinguish clearly between the two directions, and when the number of wagons to be split up daily does not exceed the capacity of the hump. »

**Mr. Moutier** (in French). — I am entirely in agreement with Messrs. Payet and Henry-Gréard, for in a case like this, even if geographical considerations are important, they are not always in themselves a criterion as regards the necessity for enlarging a shunting yard which has reached its limit of capacity. The arrangement of such a yard depends as much on the nature of the traffic to be handled and on the general scheme of work as on the directions served.

Although at the time the yard is originally constructed (that is to say, when there is no intention of increasing its capacity) the traffic is almost exclusively in one of the two directions, it may very well happen that after a certain time this state of equilibrium is disturbed. It would therefore be highly undesirable to construct a yard solely with a view to being able to double its size or to construct a parallel yard, when such a solu-

tion might not perhaps be the most suitable for the future. It is better to construct the original yard according to existing conditions, with the minimum of restrictions and the maximum capacity; and if later on it is found to be inadequate, a second yard must be provided, probably as near as possible to the first to facilitate co-operation in working, or possibly further away if such an arrangement is better adapted to the traffic conditions which have rendered the original yard inadequate and led to the construction of a second yard.

In a word, instead of saying « when the number of wagons to be split up exceeds the capacity of a hump », the statement should be made more general by saying that « when the number of wagons to be split up exceeds the capacity of a group of sidings » two yards are necessary, although they need not necessarily be parallel, any other suitable arrangement being permissible provided the two yards are in the same locality.

**Mr. Lamalle** (in French). — Mr. President, our colleague, Mr. Moutier, has completely expressed my own ideas. I would add only one word to what he has said.

When the number of wagons to be dealt with by a yard is less than the capacity of the hump, I think it is advisable, with a view to avoiding two conflicting directions of traffic on the arrival sidings, to bring in the trains from one of the directions by means of an outer loop.

**The President** (in French). — I think the question of the outer loop can be considered more appropriately later on. At present we are discussing simply the principle of having shunting sidings for each direction.



I think Mr. Lamalle is right, but his observation will be considered when we are discussing the lay-out of shunting yards.

**Mr. Pretorian** (in French). — Gentlemen, I propose that we say : « Single shunting yards must be arranged in such a way as to allow of enlargement up to the maximum capacity of a hump.

« In cases where the number of wagons to be shunted per day exceeds the capacity of a hump, it is necessary to have a group of shunting sidings for each direction of traffic. Such an arrangement is particularly desirable when the traffic in one direction is practically independent of that in the other direction. »

**The President** (in French). — The text proposed a few minutes since by Mr. Payet expressed the same idea, but in the reverse order. Mr. Payet's suggested text is as follows :

« A group of shunting sidings for each direction of traffic is advisable when the traffic in each direction is more or less independent of the other; otherwise, a single group of sidings is preferable. This is also the case when the number of wagons to be split up daily does not exceed the capacity of the splitting-up point.

« Yards containing a single group of sidings must be so arranged that it is possible to enlarge the yard for shunting in both directions when the increase in traffic so requires. »

**Mr. Pellarin** (in French). — Mr. President, I think that this wording is too strong, for, when a shunting yard has a heavy traffic which does not lend itself to a clear division between the two directions, the enlargement of the yard must not take the form of the installation of

a group of shunting sidings in the opposite direction, as if this were done there would be exchanges of wagons between the two groups of sidings which would necessitate useless splitting up operations and would destroy to a great extent the increased capacity which it was desired to give to the yard.

When the traffic cannot be clearly divided into two different directions, the solution is to open a second shunting yard at a suitable spot in the vicinity, and not to install a group of shunting sidings for each direction.

I would suggest, therefore, that we withdraw the last paragraph.

**Mr. Simon-Thomas**, *Special Reporter* (in French). — When the number of wagons to be shunted per day does not exceed 5 000, shunting in a single direction is preferable and makes for economy in staff. If, however, the number of wagons to be split up exceeds the capacity of a hump, it is necessary to divide the traffic between the two directions.

**Mr. Pellarin** (in French). — When there are two directions.

**Mr. Simon-Thomas** (in French). — There are always two directions.

**Mr. Pellarin** (in French). — No, there are not always two directions.

**The President** (in French). — Mr. Pellarin proposes the deletion of the last paragraph, and the special reporter raises no objection. Does anyone desire the retention of this paragraph?

**Mr. Pretorian** (in French). — It might stand, but with the proviso that it only applies when the traffic can be divided between the two directions.

**Mr. Payet** (in French). — We might

perhaps say: «... when the traffic has increased, thus accentuating the distinction between the two directions. »

**The President** (in French). — That would be difficult, as that would be anticipating the future.

**Mr. Payet** (in French). — Then I have no objection to the suppression of the paragraph.

**The President** (in French). — The paragraph is deleted.

« 5. — It is necessary that the number of reception tracks be such that they can receive trains on arrival so as to avoid congestion on the main line, and it is also necessary to provide for the simultaneous entrance of trains arriving by different lines.

« The length of the reception lines should be sufficient to take the longest trains; the most practical arrangement consists in placing these lines in front of the hump. »

**Mr. Moutier** (in French). — Instead of saying « in front of the hump » it would be better to say « in front of the splitting-up sidings ».

**The President** (in French). — As we have two kinds of yards, it would be better to replace the word « hump » by the words « splitting-up sidings ».

**Mr. Pellarin** (in French). — In the second paragraph it says: « the most practical arrangement consists in placing these lines in front of the hump ». In certain cases, for topographical reasons, this is not the most practical arrangement; and I think, therefore that it would be preferable to say: « a solution to be recommended consists in placing these lines in front of the hump ».

« When the width of the site of a shunting yard is greater than its length, it is sometimes more convenient to place the reception sidings by the side of the splitting-up sidings instead of prolonging the tracks.

**Mr. Payet** (in French). — I propose the following wording: « In the case of shunting sidings with a hump, the arrangement to be recommended consists... etc. »

We must not generalise the substitution of the words « shunting sidings » for the word « hump », because it is evident that when the gradient is continuous, the sidings can only be in front. We should therefore be precise and say that in the case of a hump yard, it is preferable... etc.

**The President** (in French). — Here is the wording which I propose:

« The number of reception tracks must be such that trains can be received on arrival so as to avoid blocking up the main lines, and it is also necessary to provide for simultaneous entrance of trains arriving on different lines.

« The length of the reception lines must be sufficient for the longest trains. In the case of shunting sidings with a hump, the most desirable arrangement consists in placing the lines immediately in front of the hump.

**Mr. Moutier** (in French). — This applies even more in the case of sidings on a continuous gradient.

**Mr. Descubes**, Eastern Railway of France (in French). — I cannot agree to the words « the most desirable arrangement ». What we want to get at is the most practical solution, and the most practical solution is to construct your shunting yard according to the nature of

the ground available, and subject to the limitations which it imposes.

If you wish to place the splitting-up sidings and the reception sidings end to end, you will require four kilometres of ground; but this amount of space is not always available, and therefore I consider that when a shunting yard is to be constructed, it must be left to the engineer concerned to make his plans according to the topography of the site and the space at his disposal.

**The President** (in French). — What do you propose?

**Mr. Descubes** (in French). — The suppression of the last paragraph.

**Mr. Payet** (in French). — Mr. Descubes is looking at the matter from the point of view of construction. In our remarks, however, we have confined ourselves to the point of view of working.

I think we might reconcile the two points of view by saying that « the most practical arrangement from the point of view of operating, when the topographical conditions permit... etc. ».

**Mr. Moutier** (in French). — I agree.

**Mr. Maison** (in French). — I intended to make exactly the same remark as Mr. Payet. I agree with him that we might add, after the words « the most practical solution », the words « if the topographical conditions permit ».

**Mr. Lamalle** (in French). — I am in agreement with the suggestion.

**Mr. Pretorian** (in French). — I also, because a yard is above all constructed from the point of view of operation.

**Mr. Simon-Thomas** (in French). — If the reception lines are placed alongside the sorting sidings, the capacity of the

yard and of the hump will be diminished. (*No! No!*)

It is then necessary to bring the trains up to the hump, and this occupies a lot of time.

**Mr. Descubes** (in French). — I would like to reply to the suggestion of the special reporter that the capacity of the hump would be diminished...

**Mr. Simon-Thomas** (in French). — And also of the yard.

**Mr. Descubes** (in French). — ...by stating that we have on our railways regulating yards with draw-out tracks.

When the splitting-up is continuous, the sorting works perfectly, but the reception sidings are connected with a draw-out track, not beyond the hump, but at 400 m. (440 yards) from the hump. When a group of wagons is sent down from the hump, a second group can be drawn in and placed immediately after the preceding group, so that there is no interruption in the splitting-up operations.

**Mr. Payet** (in French). — May I be permitted to recommend a solution which I consider preferable to placing two trains one behind the other. This solution consists in having two draw-out tracks side by side, which reduces the time during which shunting engines are in use, a consideration of importance from the point of view of operating. Mr. Descubes's idea is logical, and I support it, subject to the variation which I have just indicated.

**The President** (in French). — Do you wish to change the wording of the text?

**Mr. Payet** (in French). — I think that the word « operating » expresses more precisely the point of view which should be adopted.



**The President** (in French). — We will say then : « When the topographical conditions permit, the most practical solution consists in placing these lines immediately in front of the hump. » (*Agreed.*)

We will now pass on to point 6. I call on the Special Reporter.

**Mr. Simon-Thomas, Special Reporter,** read the English text of No. 6, as follows :

« 6. — The preliminary operations for splitting up the trains, which vary according to the arrangement of the yard and the traffic to be handled, should be carefully arranged so as to occupy the shortest time possible. This condition becomes most essential in winter, owing to the increased rolling resistance arising from the cooling of the oil in the axle-boxes. »

**The President** (in French). — If no one has any observations to make, I shall declare this paragraph adopted. (*Assent.*)

— Paragraph 6 is adopted.

**The President** (in French). — I will now ask the Special Reporter to read No. 7.

**Mr. Simon-Thomas, Special Reporter,** read the English text of this point.

« 7. — During the operation of splitting up the train, the indication of the particular sidings given to the pointsman should be done in a simple and clear manner, equally capable of being worked by day, by night, and during fog.

« Apart from the method of using shunting tickets, an arrangement with electric push buttons at the hump, and an electric board in the cabin, appears to be the most practical. »

**The President** (in French). — **Mr. Pellarin.**

**Mr. Pellarin** (in French). — Gentlemen, I have no objection to make to the first paragraph of point 7. It is indeed obvious that the necessary indications must be given to the pointsmen in a simple and clear manner, equally suitable for day or night. I am not, however, in agreement with the Special Reporter on the wording of the second paragraph : « Apart from the method of using shunting tickets, an arrangement with electric push buttons at the hump, and an electric board in the cabin, appears to be the most practical. »

I would say in the first place that we do not consider the shunting ticket system as being practical. We have made a number of experiments with this system, and we have found that the pointsmen have not time to consult the shunting tickets, especially in the busier yards where they have to operate a considerable number of levers. The disadvantages of the system are particularly evident when there is a change in the order of arrival of the wagons or in the lines on which they are to arrive, which happens frequently when wagons are withdrawn after they have been ticketed. In such a case the pointsman is completely at sea.

We have tried with success the system of electric push buttons at the hump with an electric board in the cabin, and at the present time we are experimenting with a new system which comprises a telephone at the top of the hump and a loud-speaker in the cabin. On the splitting-up gradient there is another very powerful loud-speaker.

We consider that this system compares favourably with the electric system, and that it is even much more practical.

In these circumstances I think it is somewhat premature to say that the electric system is the most practical.

**The President** (in French).<sup>(a)</sup> — It

would doubtless be difficult to arrive at any unanimous decision as to what system is the most practical, as local conditions, the state of the atmosphere, etc., may all modify the point of view. I think, therefore, that we might modify the wording of this paragraph, confining ourselves to indicating which systems appear worthy of consideration according to the circumstances of the case. We might say that among such systems are shunting tickets, the arrangement with electric push buttons at the hump and an electric board in the cabin, and an arrangement of loud-speakers.

**Mr. Le Besnerais** (in French). — There is also the luminous board, which shows a number visible not only from the cabin but from all parts of the sidings.

**Mr. Simon-Thomas** (in French). — These signals are not visible in a fog.

**Mr. Le Besnerais** (in French). — Yes, unless the fog is very dense.

**Mr. Simon-Thomas** (in French). — In many cases it will be local considerations which will determine the choice of system.

**Mr. Henry-Gréard** (in French). — Gentlemen, I am in agreement with what has been said, but I would like to make a brief remark with reference to the first paragraph.

This paragraph only refers to the indications to be given to the cabins, but the numbers of the tracks on which the wagons arrive must also be notified to the employees whose duty it is to stop the wagons on the sorting sidings.

I would propose, therefore, that we amplify the first paragraph by saying : «... the indication of the particular sidings given to the pointsman and *to the employees engaged in stopping the wagons*

*on the sorting sidings* should be done in a simple and clear manner... etc. »

**Mr. Pretorian** (in French). — That is not important, because the sorting lines are sufficiently long for the man who has to stop the wagons to see on which line they are arriving.

**Mr. Henry-Gréard** (in French). — No, the point is an important one, because as a rule one man has to stop wagons on two or three lines. It is therefore necessary that he should know on which line a wagon will arrive.

**Mr. Pretorian** (in French). — He waits for them on the middle line.

**Mr. Henry-Gréard** (in French). — It is preferable that he should receive warning.

**The President** (in French). — We might say, then : « ... to the pointsman and where *necessary* to employees who are engaged in stopping the wagons... »

**Mr. Pretorian** (in French). — We must not make it too definite.

**The President** (in French). — Let us say, then : « ... and, where necessary, *to the rest of the shunting staff...* » (*Agreed.*)

The complete text will now be as follows :

« 7. — During the operation of splitting up the trains the indication of the particular sidings given to the pointsman, and where necessary to the rest of the shunting staff, must be given in a clear and simple manner equally capable of being worked by day, night, or during fog. Methods vary according to circumstances.

« Among the various systems the following may be noted as particularly interesting : shunting tickets; electric push buttons at the hump with electric board

in the cabin; the use of loud-speaking telephones and luminous signals. »

— This text is adopted.

« 8. — Communication between the driver of the shunting locomotive and the foreman shunter and pointsman should be such that the orders given by the shunter can be carried out immediately by the driver.

« The installation of an electric bell in the cab of the locomotive appears to be the simplest and most practical solution. »

**Mr. Pellarin** (in French). — I agree with the first paragraph, as it is essential to be able to give orders rapidly to the driver, but I cannot accept the second paragraph.

The installation of an electric bell in the cab of the locomotive — an installation which necessitates a quite complicated mechanism — is calculated to distract the attention of the driver from the line. Not only is it not the simplest solution, but in my opinion it is not a practical one.

On the Eastern Railway we have adopted a system which, when the line giving access to the hump is straight, consists of a mast with luminous signals which indicate to the driver what he has to do. This system does not necessitate either wires along the hump, or electrical contacts, or apparatus such as the « chariot », the working of which may be defective at certain moments.

**Mr. Lamalle** (in French). — I agree to the first paragraph but, like Mr. Pellarin, not to the second.

Like him, I consider that the electric bell is a complicated arrangement, firstly because of the difficulty of installing it, and secondly because of the necessity of providing each shunting engine...

**Mr. Simon-Thomas** (in French). — Not at all.

**Mr. Lamalle** (in French). — I prefer the system of luminous signals repeated at short distances which the driver can easily distinguish.

**Mr. Descubes** (in French). — Were is the electric bell system in use?

**Mr. Simon-Thomas** (in French). — Chiefly in Germany.

**Mr. Moutier** (in French). — We have first of all, it appears to me, to consider the case of working without shunting engines. In this case there is obviously no question of communication between the driver, the foreman shunter and the pointsman.

We should, therefore, begin by saying : « In cases where use is not made of sidings on which the splitting-up is done by gravitation, and where use is not made of a shunting engine, it is desirable to install... etc. »

It is evident, I repeat, that it is only necessary to establish communication with the driver when there is a shunting engine.

**Mr. Pellarin** (in French). — It would be simpler, I think, to delete the paragraph.

**The President** (in French). — It is, however, necessary to establish communication between the foreman shunter and the men who receive the wagons.

I propose the following wording : « If it is necessary to have a shunting engine, communication between the driver of the shunting engine and the foreman shunter and pointsman should be such that the orders given by the shunter can be carried out immediately by the driver. »

Certain members have considered that the electric bell is not always satisfactory, and they are of opinion that it would be better to make no reference to actual



means of communication; in that case we might delete the second paragraph.

**Mr. Lamalle** (in French). — Instead of deleting the second paragraph outright, we might amplify it by mentioning the various systems, so that those who read the report of our proceedings will know that there are certain new systems in existence, such as the electric bell and luminous signals.

**The President** (in French). — Two propositions are before us : one is simply to delete the second paragraph, and the other with a view to avoiding any suggestion of incompleteness, is to say that the systems in use vary according to circumstances, but that in certain cases use is made of electric bells and luminous signals.

**Mr. Moutier** (in French). — I ask that the luminous signals be given first place.

**The President** (in French). — I propose, therefore, that the second paragraph read as follows : « Among the various systems the following may be noted : luminous signals, and electric bells in the cab of the engine, etc... » (*General approval.*)

We now come to No. 9, which I would ask the Special Reporter to read to us.

**Mr. Simon-Thomas, Special Reporter**, read the English text, as follows :

« 9. — It is necessary to design the hump or the grade at the splitting-up sidings as accurately as possible, taking account of the various resistances that affect the running of the wagons as they come over.

« The influence of wind resistance being considerable, the splitting-up sidings should be arranged in the most fa-

vourable direction in relation to the prevalent winds. »

**The President** (in French). — **Mr. Moutier.**

**Mr. Moutier** (in French). — Gentlemen, I wish to make just one remark : in the second paragraph it is stated that it is necessary to construct the splitting-up sidings in the most favourable direction in relation to the prevalent winds. This, however, is not always possible. It would be better to say : « An endeavour should be made to arrange the splitting-up sidings..., etc. »

**Mr. Pretorian** (in French). — Let us say : « It is preferable. »

**The President** (In French). — We might say : « ... the splitting-up sidings should, *where possible*, be arranged... » (*Agreed.*)

— Point 9 as amended is adopted.

**The President** (In French). — We now pass to No. 10.

**Mr. Simon-Thomas** read the English text, as follows :

« 10. — The radius of curvature of the top of the hump in vertical section should be at least 200 m. (10 chains). »

— Adopted.

**Mr. Simon-Thomas** then read the English text of No. 11 :

« 11. — The hump should be of adequate height for giving sufficient speed to all wagons to enable them to reach any point on the shunting sidings, even when the atmospheric conditions are unfavourable. This speed should be such that the wagons are spaced sufficiently far apart on reaching the foot of the steep gradient of the hump.

« To obtain this speed, it is necessary that the total height of the hump should consist, as far as possible, of a single steep gradient.

« The speed of the wagons should be reduced by means of a rail-brake. The automatic rail-brake with counter-weight, in which the action is exerted by four brakeraills arranged on both sides of the track-rails, is preferable to any other method. »

**Mr. Pellarin** (in French). — Gentlemen, I have no observations to make on the first two paragraphs. It is correct that the hump must be sufficiently high to ensure that, even in unfavourable weather, the wagons do not stop at the points, otherwise marshalling and splitting-up operations would be obstructed. It is also correct that the hump must be as steep as possible, and that the descent should be sufficiently short to give a suitable spacing of the wagons. But I suggest that we delete the last paragraph, since, although it may be correct that different systems must be used for reducing the speed of the wagons, it appears very doubtful whether the system of the automatic rail-brake is preferable to all others.

This system, which is adopted, I believe, in Germany, may be useful at the top of the hump in order to control the speed on departure — which is equivalent to reducing the effective height of the hump, — but it is not to be recommended on the sorting gradient. This brake, in fact, works solely under the weight of the wagon; it is not, however, the weight of the wagon which is the chief consideration, but the speed at which it reaches the track on to which it has to run, and the number of wagons already on that track.

It is beyond question that if a track 700 m. (770 yards) long is holding wagons on 600 m. (660 yards) of its length, heavy braking will be required to stop the wagon; whereas, if a wagon of the same weight is running on to a track which is completely empty, it will not be necessary to check its speed.

I propose, therefore, that we delete the last paragraph, since there are a variety of methods for reducing speed, and it is not possible to say that any one system is preferable to all the others.

Mr. Moutier will tell you shortly of a system which has been tried by the Northern of France Railway, and which appears likely to prove satisfactory.

**The President** (in French). — Before opening the discussion on this paragraph I think it well to draw your attention to the fact that there are certain systems which are applicable to hump working and others which are applicable to continuous gradient working.

Will it not be necessary for us to re-draft No. 11, inserting a clause concerning the speed of wagons on a continuous gradient?

**Mr. Moutier** (in French). — I think that it would be regrettable to state in this article that it is necessary to resort exclusively to the special appliances indicated for, even if their value is unquestionable, they are certainly not the only means of solving the problem.

The automatic method gives results which depend on the apparatus itself. And if the braking is in all cases dependent on the weight of the wagon, it does not allow for the nature of the load, still less for the speed and the distance to be covered. This is the reason why, on the Northern of France, we prefer another

system to the automatic brake, namely a system which depends on the employees themselves, who are in a position to regulate the braking according to the circumstances of the moment. We have adopted a system, devised by one of our officials, which consists in using ordinary slipper brakes which are moved about from the cabin itself to the appropriate spot for giving the right braking distance according to the make-up of the batch of wagons released, the nature of their load, the state of the rails, the direction and force of the wind, etc... This system, which is perfectly simple, comprises a small carrier with a catch fixed on an endless cable which can be moved by means of an electrical mechanism in the cabin in either direction, either to bring the catch to the desired spot on the track, or to disengage it immediately and leave it completely free before the batch of wagons released comes into contact with it.

**The President** (in French). — Will the speaker kindly come a little nearer and speak a little louder, as his remarks do not reach the chair distinctly.

**Mr. Moutier** (in French). — This system has proved most serviceable, and we recommend it. If you will permit me, I will insert a description of the apparatus in the report.

**Mr. Pretorian** (in French). — The first paragraph of No. 11 commences thus :

« The hump should be of adequate height for giving sufficient speed to all wagons to enable them to reach..., etc. »

When a shunting track is long, light wagons must be able to acquire a speed which enables them to reach the end of

the line without the intervention of the shunting engine.

I think the wording should be altered to state that the hump must be sufficiently high to enable all wagons, however difficult the running conditions, to reach the end of the shunting line.

**Mr. Simon-Thomas** (in French). — We might say : « The hump must be sufficiently high to enable wagons under difficult running conditions to reach the end in the shunting lines. »

**Mr. Pretorian** (in French). — Exactly.

**Mr. Descubes** (in French). — In the first paragraph it is stated : « This speed should be such that the wagons are spaced sufficiently far apart on reaching the foot of the steep gradient of the hump. »

Strictly speaking the spot at which the wagons must be spaced sufficiently apart is not the foot of the hump but the first set of points.

I would like a word of explanations as regards the second paragraph. What is meant by « the total height or fall of the hump »? Is it the difference in elevation between the point at which the wagons are uncoupled and the level portion of the sidings, or is it the difference in elevation between the uncoupling spot and the location of the first points?

**The President** (in French). — What wording do you suggest?

**Mr. Descubes** (in French). — I suggest that we say : « The total height of the hump is the difference of level between the hump and the different sets of points. »

**Mr. Maison** (in French). — The first paragraph says : « The hump should be of adequate height... » I think we should



add : « and the gradient of the continuous slope sufficiently steep... » I also consider that we should delete the second paragraph.

My wording would be as follows : « The hump must be of adequate height, and the gradient of the continuous slope sufficiently steep, to give sufficient speed to all wagons to enable them..., etc. »

The President (in French). — It was arranged that we should sit until 1.0

o'clock. The time has therefore come to adjourn the meeting.

It appears that the only difference of opinion is as to the exact wording of article 11, and I suggest that it be left to the secretariat to draft a wording which shall be submitted to you at the meeting to-morrow, such draft to take into account the different observations which have been made this morning. (*Agreed.*)

— The meeting adjourned at 1.15 p. m.

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Meeting held on 24 June 1925 (morning).

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Mr. DU CASTEL, PRESIDENT OF SECTION III, IN THE CHAIR.

— The meeting opened at 9.30 a.m.

The President (in French). — Gentlemen, I asked Mr. Trench to take the Chair at this meeting, but he remarked that we must conclude this morning the discussion on the question of shunting yards, and that, as it was I who proposed the suppression of the afternoon sessions, he left it to me to conduct the discussion with sufficient rapidity to complete the inquiry into this question this morning. I have no doubt that, with your goodwill, we shall have no difficulty in doing so.

You will have noted, gentlemen, that the report of yesterday's meeting, published in the *Daily Journal of the Congress*, contains several inaccuracies. The report will be rectified in the next number of the *Daily Journal*.

We will now resume the discussion on the question of shunting yards.

In accordance with the decision come to yesterday, your secretariat has prepared a revised draft for article 11.

You will have seen the text of this on page 6 of *Daily Journal* No. 2. We believe it has taken into account all the observations which were made during yesterday's discussion.

We propose the following wording for your approval :

« 11. The height of the hump or the gradient of the continuous slope should be such that all the wagons, whatever their running conditions, attain sufficient speed to reach their correct destination on the shunting lines, and in particular the extremity of such lines; this result ought to be obtained even under unfavourable atmospheric conditions. The speed should, moreover, be such that when the points are reached the wagons have sufficient interval between them. This speed must be attainable on a continuous gradient, additional inclination should be given after the points in order to counteract the resistance due to curves and reverse curves. »

Mr. Pellarin (in French). — Gentle-

men, this wording is perhaps a little too strong; it states that the wagons must be able to attain sufficient speed to reach their correct destination on the shunting lines, and in particular the extremity of such lines; and it adds that this must be the case even under unfavourable atmospheric conditions. If, however, this requirement is to be complied with in cold countries, you will need a hump some ten metres (32 ft. 9 in.) high, the influence of low temperatures being considerable. I consider, therefore, that the original wording was better, and I propose that we delete the words « and in particular the extremity of such lines. »

The President (in French). — These words were added at the request of Mr. Pretorian.

Mr. Pellarin (in French). — The condition that the wagons must be able to reach the extremity of the shunting lines, even when atmospheric conditions are unfavourable, will make it necessary to have an unduly high hump.

Mr. Moutier (in French). — Let us say merely : « to reach their correct destination... »

Mr. Pretorian (in French). — We could delete the phrase : « This result ought to be obtained even under unfavourable atmospheric conditions ».

The President (in French). — Are we agreed to delete the reference to unfavourable atmospheric conditions?

Mr. Pellarin (in French). — I think it is more important to retain this condition than that which says that the wagons must be able to reach the extremity of the shunting lines. The important point, indeed, in constructing a hump is to design it in such a way that it will

work satisfactorily even in bad weather. This is where the greatest difficulty is encountered.

The President (in French). — Mr. Pellarin is thinking of the case of the cold countries, while Mr. Pretorian is referring to countries with a warmer climate. Both cases have their interesting features.

Mr. Pellarin (in French). — Exactly, but if you say that the wagons must be able to reach the points which they ought to reach you meet both cases.

Mr. Simon-Thomas, *Special Reporter* (in French). — Yes, it would be sufficient to say that.

Mr. Pretorian (in French). — I will not press the point.

The President (in French). — We delete, then, the words « and in particular the extremity of such lines ». (*Agreed.*)

Mr. Wasiutynski, Polish State Railways (in French). — Gentlemen, the last phrase : « additional inclination should be given after the points in order to counteract the resistance due to curves and reverse curves », does not appear to me to be particularly clear. It might be taken to mean that a steeper gradient is recommended beyond the points, which certainly cannot be the meaning intended. If the height of the hump is sufficient, the wagons will reach the correct spot, in spite of the resistance due to curves and reverse-curves.

The President (in French). — This phrase was introduced at the suggestion of Mr. Descubes, who wished to emphasize the necessity of counterbalancing the resistance due to curves and reverse-

curves by means of a certain inclination in the area beyond the points.

**Mr. Wasiutynski** (in French). — If the resistances do not prevent the wagons from arriving at the extremity of the sorting tracks, it is not necessary to have an inclination after the points.

**The President** (in French). — We might say : « inclination may usefully be given » instead of « should be given ».

**Mr. Maison** (in French). — Gentlemen, once you have said that the speed of the wagons must be such that they are able to reach their destination on the shunting lines, it appears to me unnecessary to introduce other conditions : the first suffices.

I think, therefore, that it would be better to delete the whole of the final phrase.

**The President** (in French). — Do you insist on your suggestion, Mr. Descubes?

**Mr. Descubes** (in French). — No, Mr. President, because I believe the question of having this inclination after the points will arise later when we are considering one of the other articles.

**Mr. Moutier** (in French). — Let us delete the phrase.

**The President** (in French). — I believe we are agreed that the last phrase shall be deleted. (*Agreed*).

It is therefore deleted.

We now come to a new point 12, replacing the latter part of the original point 11, and reading as follows :

« It must be possible to reduce the speed of wagons if necessary; for this purpose various systems are in operation, amongst which may be mentioned slipper brakes, automatic rail-brakes, etc. »

**Mr. Moutier** (in French). — We ought to add : « and electrically controlled slipper-brakes ».

**The President** (in French). — Certainly, this point has been overlooked.

**Mr. Le Besnerais** (in French). — What are electrically controlled slipper-brakes? I have never seen a description of them.

**The President** (in French). — Article 12, replacing the last part of article 11 of the special report, might be worded as follows :

« It must be possible to reduce the speed of the wagons if need be. Various systems are in use for this purpose. Among these, mention may be made of slipper-brakes, automatic rail-brakes, and electrically controlled slipper-brakes, etc.» (*General agreement.*)

« 13 (12 of the special report). — The construction of a hump with two arrival tracks at different levels is only necessary when the difference in resistance due to favourable and unfavourable atmospheric conditions is such that a hump constructed for the most unfavourable conditions does not allow of the wagons being stopped effectively when conditions are favourable. »

**Mr. Gaeremynck** (in French). — The system of access to the hump has nothing to do with the speed of wagons.

**Mr. Simon-Thomas** (in French). — No.

**Mr. Gaeremynck** (in French). — Why then refer to the arrival tracks?

**Mr. Simon-Thomas** (in French). — Two tracks on the hump.



**The President** (in French). — You must read the phrase to the end : « the construction of a hump with two arrival tracks at different levels... »

**Mr. Gaeremynck** (in French). — What is the object in reaching the top of the hump by means of two different tracks at different levels?

**Mr. Simon-Thomas** (in French). — There are always several metres between the splitting-up point and the points.

**Mr. Gaeremynck** (in French). — When going up nothing is gained; and what advantage is there as regards the descent?

**Mr. Simon-Thomas** (in French). — When mounting the slope there are the points on the steep gradient and the splitting-up point.

**Mr. Gaeremynck** (in French). — It is a case of two humps of different height.

**Mr. Simon-Thomas** (in French). — It is a case of two tracks.

**The President** (in French). — If I have understood Mr. Gaeremynck correctly, he wishes to begin with the words : « The construction of a hump having two different levels... »

**Mr. Lamalle** (in French). — Do you not think it would be better to say : « The construction of a summer hump and of a winter hump », which would indicate the necessity of providing against atmospheric conditions?

**Mr. Simon-Thomas** (in French). — It is in winter that the atmospheric conditions are most unfavourable.

**Mr. Lamalle** (in French). — There are yards which have one hump for

summer working and another for winter working.

**Mr. Simon-Thomas** (in French). — I think you are mistaken.

**Mr. Pretorian** (in French). — Even in summer atmospheric conditions may vary. I suggest that we say : « The construction of a hump with supplementary arrival lines at different levels is only necessary if... »

**The President** (in French). — The wording proposed is as follows : « The construction of a hump having two different levels is only necessary if..., etc. »

**Mr. Maison** (in French). — To make the phrase clearer, I think we should delete the words « when the difference in resistance due to favourable and unfavourable atmospheric conditions is such », and say : « is only necessary if a single hump, designed to allow for atmospheric influences, does not permit of stopping the wagons when circumstances are favourable.

**Mr. Wasiutynski** (in French). — I think there is some contradiction. We first talk of one hump, and then of another hump.

**The President** (in French). — We might word it as follows : « The construction of a hump having two different levels is only necessary if a hump with a single level, designed to allow for the most unfavourable atmospheric conditions, is not sufficient. »

**Mr. Maison** (in French). — At the end of article 12, I read : « to enable the wagons to be stopped when circumstances are favourable ».

That is not correct. It should read : « to enable the wagons to be stopped at the correct spot ».

**The President (in French).** We must distinguish between favourable and unfavourable circumstances.

« 13. — At humps arranged with a single arrival track, a track adjacent to the hump may be used with advantage as a road on which the auxiliary locomotive used for pushing up the wagons on the shunting siding may stand. »

**The President (in French).** — I wish to point out, Gentlemen, that there has been an alteration in the English text.

**Mr. Lamalle (in French).** — I would like a word of explanation from the Reporter on article 13, which I do not altogether understand.

**Mr. Simon-Thomas, Special Reporter, (in French).** — Gentlemen, the explanation desired by Mr. Lamalle is this : if the atmospheric conditions are unfavourable, it may happen that the wagons are unable to reach the position on the sorting line which they ought to reach. If, then, the wagons stop at different spots on the slope, it will be advisable to have an auxiliary locomotive near to the hump for pushing them up. This will be especially necessary in winter.

**Mr. Wasitynski (in French).** — I think, Gentlemen, that this article ought to be worded in a more general sense. There are, in fact many other reasons which may justify the presence of a track adjacent to the hump; it should not be said that this track must be reserved exclusively for an auxiliary locomotive used for pushing up the wagons which have stopped short of their destination. I propose that we say : « A track adjacent to the hump may be provided with advantage for the passage of locomotives, as well as for wagons which have not to pass over the hump. »

(The speaker translates his remarks into English himself.)

**The President (in French).** This suggestion is quite correct.

**Mr. Pellarin (in French).** — Gentlemen, I think that the text of this article must be revised, seeing that it is not only when there is a single arrival line that an adjacent track is useful. Further, as the Polish delegate has just pointed out, this adjacent track must not be reserved exclusively for an auxiliary locomotive used for pushing up the wagons which have stopped short.

I propose that we say :

« As a rule it is of advantage to have avoiding lines. »

**Mr. Lamalle (in French).** — I agree with Mr. Pellarin : an avoiding line is necessary in order to avoid having to send over the hump wagons which need not necessarily pass that way. But that does not meet the observation made by the Special Reporter. The latter refers to the pushing up of wagons which come to rest too soon when descending the hump. I do not think it necessary, then, to have an auxiliary shunting engine waiting near to the hump to push up these wagons; the shunting engines themselves can push them up, and if the stoppages are frequent, the gradient must be modified.

**The President (in French).** — We might adopt Mr. Pellarin's wording, adding the words : « particularly for pushing up wagons which have stopped »,

**Mr. Payet (in French).** — The two questions are entirely distinct : there must be two separate lines, one an avoiding line and the other a small line with a dead-end for the engine used for pushing up wagons which have stopped at the points. During the pushing-up operation, it may be necessary to use the avoiding line.

**Mr. Lamalle (in French).** — Mr. Payet's observation was based on my own

remark. He has exactly expressed my idea, and I agree with his suggested wording.

**The President** (in French). — Mr. Payet has not put forward any amendment.

**Mr. Lamalle** (in French). — He has said that it is necessary to have an avoiding line, and in addition a small line with a dead-end for the engine used for pushing up wagons which have been released with insufficient impetus.

**Mr. Trench**, *President of the 1st section*. — It seems to me that we are rather arguing about a very small point. It is necessary to have an avoiding line, a line that does not go over the hump, and that line will be used for various purposes, for drawing out the wagons, or for an engine avoiding the hump; but it is not always necessary to have a dead-end siding.

**Mr. Wasiutynski** (in French). — Gentlemen, a few moments ago I ventured to suggest the following wording :

“ ... a track adjacent to the hump may be provided with advantage for the passage of locomotives as well as for wagons which have not to pass over the hump.”

I still think that this wording is the only suitable one. I am not in favour of a dead-end line, because a track connected by points with the tracks passing over the hump is much more useful. What we should say is that it is an advantage to have avoiding lines. These will be used for pushing up the wagons or for any other purposes, according to requirements. There will be one avoiding line, or several, according to local needs.

**Mr. Maison** (in French). — We are spending time on details, when we ought to be laying down general lines.

I propose that article 13 be deleted.

**Mr. Montier** (in French). — I support Mr. Maison's proposition. This article is useless.

A few moments ago we added a new article; if now we delete it, we return to the former position.

**The President** (in French). — Are we agreed that this article shall be deleted?

**Several Members**. — No! No!

**Capt. Gordon**, North Western Railway, India. — I propose that article 13 stand as it is now. It is perfectly clear as it is, and I oppose its deletion.

**Mr. Lamalle** (in French). — Mr. President, I beg leave to submit to the meeting a wording, which may require a little adjustment, because I have not had the time to draft it properly, but which appears to me to meet the points which have been put forward during the discussion :

“ It is an advantage to have an avoiding line. Further, a dead-end line connected with the avoiding line is desirable for holding an auxiliary locomotive used for pushing up the wagons which have stopped on the gradient.”

**The President** (in French). — I am afraid your wording is a little too definite : there are railways which work under other conditions.

**Mr. Montier** (in French). — Do not let us enter into these details. Let us delete the article.

**Mr. Wasiutynski** (in French). — I am not in favour of its deletion.

**The President** (in French). — Since we are not in agreement, I will put to the vote the proposition that the article be deleted.

— The proposition for deletion is not carried.



**The President** (in French). — « It is usually advisable to have loops round the hump. » If we wish to avoid a false interpretation we must add : « and in some cases a dead-end track ».

**Mr. Descubes** (in French). — Exactly.

**The President** (in French). — We will say, then : « It is usually advisable to have loops round the hump, and sometimes a special dead-end for the shunting engine used for moving wagons which have stopped on the sidings. »

**Mr. Descubes** (in French). — We are all agreed.

**The President** (in French). — This wording is adopted, then.

« 14 (of the special report). — The head of the group of shunting sidings should be arranged as near as possible to the top of the hump or the splitting-up point.

« The minimum distance between the top of the hump and the first pair of points should be 15 m. (50 feet). »

« It is necessary that the head of the group of sidings should be so arranged that the tracks do not give too great differences of resistance in relation to one another and that the distance from the foot of the gradient to the fouling point should be as short as possible, and nearly the same for all tracks.

« If necessary, the head of the group of sidings may be constructed on a plane of sufficient inclination to overcome the resistances due to the curves and reverse curves. »

**Mr. Wasiutynski** (in French). — I think that a distance of 15 m. (50 feet) between the top of the hump, and the first pair of points is much too little. The gradient cannot be greater than 4/100. With this gradient, the height

of the hump is not more than 60 cm. (2 feet). I do not understand, therefore, this limit of 15 m. (50 feet). I consider it dangerous to fix a minimum for the distance between the top of the hump and the points, for the height of the hump must be taken into consideration. If we state a figure we introduce the idea of a maximum gradient and a minimum height of hump.

**Mr. Simon-Thomas** (in French). — In Switzerland there are yards in which there is a distance of 15 m. (50 feet) between the splitting-up point and the points. The results in practice leave nothing to be desired. At Zurich the distance is 9 m. (30 feet), and this also proves quite satisfactory.

We ask, therefore, that the figure of 15 m. (50 feet) be allowed to stand, for it is not excessive. My Swiss colleagues are in agreement with me on this point.

**Mr. Wasiutynski** (in French). — I consider it desirable that this distance should be as short as possible, in order to give the shunting yard the greatest possible output. I recognize, however, that it is difficult to lay down a minimum.

**Mr. Pretorian** (in French). — The words : « as near as possible » do not accurately express the idea of the Reporter, because from the point of view of construction, the head of the sidings must be placed immediately after the hump.

**Mr. Renard** (in French). — I would like to propose the following wording, which is a little longer :

« It is desirable that the distance between the top of the hump and the first pair of points at the head of the sidings should be reduced to a minimum.

This minimum distance depends indirectly on the gradient of the hump line and directly on the time required by the pointsman for operating the first system of points at which the wagons or group of wagons released have arrived; it must, in effect, be possible for this to be done between the time when the wagons or group of wagons first sent down have crossed the last set of points and the moment when the following wagons or group of wagons arrive at the first pair of points of the sidings. A coefficient of safety must be adopted. Practice has shewn that this distance cannot be reduced below 15 m. (50 feet) ».

**The President** (in French). — This wording is, in fact, somewhat long. I would propose to simplify it by saying:

« The minimum distance depends indirectly on the gradient of the hump line, it depends directly on the time required by the pointsman for operating the system of points reached by the first wagon, and the system of points about to be negotiated by the wagon leaving the hump. »

**Mr. Maison** (in French). — There is obviously a divergence of views, which shows that we should do better to confine ourselves to broad lines rather than enter into details. I consider that the first sentence of No. 14 is adequate, and that the remainder can be dispensed with.

**The President** (in French). — Taking as a guide what has been said by Mr. Pretorian, we might say : « It is desirable that the distance between the top of the hump and the first pair of points at the head of the sidings... »

**Mr. Moutier** (in French). — That is not sufficiently categorical. I prefer : « It is necessary » or « it is essential ».

**The President** (in French). — The wording will continue thus : « Practice has shewn that this distance cannot be reduced below 15 m. (50 feet). »

**Mr. Maison** (in French). — Why say 15 m., since we have heard that in certain yards the distance is 9 m.?

**Mr. Renard** (in French). — In practice the distance is rarely 15 m.

**Mr. Maison** (in French). — I repeat my proposition that the paragraph be deleted.

**Mr. Wasiutynski** (in French). — It is essential to be able to reduce as much as possible the space between the sets of wagons. With this object the points may be placed on the gradient itself as near to the top as possible.

**The President** (in French). — In order to avoid mentioning the distance of 15 m. we might say : « It is desirable to reduce to a minimum the distance between the top of the hump and the first pair of points at the head of the sidings. »  
(Agreed.)

**The President** (in French). — We now pass to the third paragraph : « It is advisable that the lay-out of the head of the sidings should be such that there is no great difference between the resistances offered by the different roads, and that the distance between the bottom of the gradient and the fouling point should be as short as possible and more or less equal for all the roads. »

**Mr. Pretorian** (in French). — This paragraph speaks of the distance between the foot of the gradient and the fouling point. If, however, the points are on the gradient, the paragraph is not correct, and should be amended to read : « the

distance between the first pair of points and the fouling point ».

**The President** (in French). — It should read : « the distance from the top of the hump to the splitting-up point ».

**Mr. Moutier** (in French). — The text proposed is quite clear.

**The President** (in French). — Do you press your amendment, Mr. Pretorian?

**Mr. Pretorian** (in French). — I will not oppose the text proposed, but I do point out that in certain cases it is not exactly correct.

— The third paragraph is adopted.

**The President** (in French). — The last paragraph reads as follows : « If necessary, the head of the sidings can be given a sufficient incline to overcome resistances due to curves and reverse curves. »

— Adopted.

**Mr. Descubes** (in French). — Mr. President, we are discussing points of detail. There is, however, in the report of Messrs. Moutier and Pellarin a very important point on the working of the points at the heads of the shunting sidings, and I find no mention of it in the special report of Mr. Simon-Thomas.

In view of the undoubted importance of this question, I ask for the insertion of this point, the wording of which I would propose as follows :

« It is to be recommended, from the point of view of economy of staff, that the points at the head of the sidings be worked from central posts; these posts operate the points either by wire rope or by means of fluid pressure. Certain systems have safety pedals which prevent the

moving of the points under the wagons; use is also made of semi-automatic apparatus which enables the shunter to operate by a single movement all the points giving access to a shunting line, the points moving in turn as the wagons approach. »

**Mr. Moutier** (in French). — Gentlemen, I support Mr. Descubes' proposition, but I would suggest that we do not indicate as sole motive the economy of staff, which, in my opinion, is only a secondary motive. The principal advantage in the system of operating the points from a distance is that it ensures greater regularity of working, accelerates splitting-up and avoids mistakes, the latter being a consideration of the utmost importance. The economy in staff is certainly not negligible, but it is not the first consideration.

I have also a few remarks to make about the end of the article.

It says that certain systems include the use of safety pedals which prevent the moving of the points under the wagons. Certain railways, however, have found these pedals useless, and others have found them dangerous; it is all a question of opinion, and the trials have not yet been sufficiently extensive to be conclusive.

**Mr. Descubes** (in French). — It is for that reason that I merely mentioned the systems in use, without referring specially to any one system.

**The President** (in French). — The secretariat will revise the wording of the text submitted by Mr. Descubes. The question will therefore be deferred for the moment. (*Agreed.*)

**Mr. Lamalle** (in French). — Gentlemen, there is one point which has not been mentioned, but which appears to me



to be important. I do not ask that it be added to the existing articles, but I wish to draw attention to it.

Since working is done by gravity, it is desirable, when constructing an entirely new yard, that the sidings in front of the hump should be at a higher level than the sidings behind, to avoid undue demands being made on the shunting engine. By this means the net cost per wagon shunted is reduced.

**Mr. Simon-Thomas**, *Special Reporter*, (in French). — I have referred to that in my report.

**The President** (in French). — Mr. Lammalle's observation will be recorded in the minutes.

« 15. — The number of tracks in the shunting sidings depends on the traffic to be handled, and on the instructions relating to the make-up of the goods trains. In determining this number, account must be taken of the maximum possible, that is, 35 to 40 for level yards with humps. It must not be overlooked that the addition of sidings for some supplementary routes may appreciably facilitate the make-up of semi-through trains.

« The effective length of the shunting sidings depends on the length adopted for the through trains, with the addition of a certain length corresponding to the distance necessary for stopping the last wagons.

« In yards arranged on a continuous gradient it is necessary that the slope of the shunting sidings should be from 5 to 7 ‰ in order that the sets of wagons may be set running under the action of gravity alone ».

**Mr. Wasiutynski** (in French). — The minimum of 5 ‰ appears to me insufficient, judging by our experience in

Poland. We have a shunting yard on a continuous gradient, with auxiliary humps. In this yard it has been found necessary to increase the speed of the wagons by means of humps to enable them to reach the extremity of the shunting lines which have a slope of 5 ‰.

**Mr. Simon-Thomas** (in French). — Perhaps the atmospheric conditions in Poland are more unfavourable.

**Mr. Wasiutynski** (in French). — They are not different from those in other countries of central Europe. At the station at Nuremberg it was also found that a slope of 5 ‰ was not sufficient in winter, and this has had to be remedied by the addition of a hump.

**The President** (in French). — We are obliged to take into account the existing minimum, and I do not think there are any continuous gradient yards in which the slope is less than 5 ‰. If we say from 5 to 7 ‰, we are nearer to the facts.

**Mr. Pretorian** (in French). — I consider that in constructing shunting sidings one should not be guided exclusively by instructions relative to the make-up of trains. The first consideration must be the possibilities of the particular case, and for this reason I consider that we should replace the first paragraph of No. 15 by the following :

« The number of lines in the shunting sidings depends on the number of directions to be served, the size of the sidings for sorting according to destination, and the quantity of installations supplementing the shunting yard, namely transshipment platforms, weighing-machines, wagon repair shops, installations for cleaning and disinfecting the wagons, etc. »

**Mr. Renard** (in French). — The number of directions to be served is one of the factors comprised in the word « traffic »; that is why the words « depends on the traffic » have been used.

**Mr. Pretorian** (in French). — But the amount of traffic varies according to the number of lines.

**The President** (in French). — In order to meet our colleague's point we might say : « The number of tracks depends on the traffic to be handled », and, in brackets, « density of traffic », number of directions, supplementary installations, etc. »

**Mr. Simon-Thomas** (in French). — All that is covered by the reference to « instructions ».

**Mr. Trench**. — I do not know whether there are any American delegates here, but the number of sidings in a yard is stated quite definitely here as being a maximum of 35 to 40, and it would be interesting to us to hear whether the American delegates agree with that as a maximum number of sidings suitable for a hump yard.

**Mr. Pretorian** (in French). — I propose that we replace the second paragraph of No. 15 by the following :

« The effective length of the shunting sidings will depend on the maximum length of the trains which have to be made up in the yard, plus the necessary length for holding wagons sorted in the rear, or for the wagons which will form the train during the time necessary for completing the operation of coupling the wagons of the train and transferring them to the sorting sidings, whether for the sidings for sorting according to destination, or for the departure sidings, or for preparing for the despatching of the

trains. This additional length will not, however, exceed half the maximum length of the train to be made up ».

**Mr. Maison** (in French). — Gentlemen, the observation which I wished to make was much the same as that of Mr. Pretorian, though I would prefer the wording to be somewhat shorter.

It has been said that the effective length of the shunting sidings depends on the length adopted for the through trains. That is quite correct, but there is another factor which is very important, namely, the necessity of being in a position to effect the sorting at the head of the sidings opposite to the splitting-up point or on the marshalling sidings at the extremity of the yard. This is a case which is quite general.

I think, therefore, that we might say :

« The effective length of the shunting sidings depends on the length adopted for through trains, and must be sufficient to allow, where necessary, of effecting sorting operations at the head of the sidings opposite the splitting-up point. »

Then would follow the last sentence of the wording proposed by the reporter : « It is supplemented by a certain length corresponding to the distance necessary for stopping the last wagons. »

**Mr. Lamalle** (in French). — I agree with this wording.

**Mr. Wasiutynski** (in French). — I also.

**Mr. Pretorian** (In French). — I am quite prepared to accept this wording provided we say : « ... the maximum length adopted for the trains », leaving out the words « through trains ».

**Mr. Maison** (in French). — I have no objection to this deletion.

**The President** (in French). — It will read, then :

« The effective length of the shunting sidings depends on the maximum length adopted for the trains, and must be sufficient to allow, where necessary, of effecting sorting operations at the head of the sidings opposite the splitting-up point. It is supplemented by a certain length corresponding to the distance necessary for stopping the last wagons. »

— This wording is adopted.

**The President** (in French). — The last paragraph reads thus :

« In yards arranged on a continuous gradient it is necessary that the slope of the shunting sidings should be at least  $5 \text{ }^{\circ}/\text{‰}$  in order that the sets of wagons may start running under the action of gravity alone. »

— Adopted.

**The President** (in French). — We now come to point No. 16 of the special report.

« In yards arranged on the level, departure direct from the shunting sidings is advisable, unless the density of traffic requires the transfer of trains to groups of departure sidings immediately after marshalling. »

**Mr. Pretorian** (in French). — Gentlemen, I would like to point out that there is a whole series of operations to be performed after the sorting of the wagons on the shunting sidings.

In the first place it is necessary to distribute the brake wagons. Certain railways have an insufficient number of brake wagons. It is essential, therefore, to ensure that the braking arrangements are carried out in accordance with instructions, which are very precise in this respect. This necessitates additional shunting movements.

It is then necessary to add the luggage vans to the trains, and, finally, to fix the regulation lights at the rear of the end wagons.

**Mr. Simon-Thomas**, *Special Reporter* (in French). — All that is part of the make-up of trains.

**Mr. Pretorian** (in French). — It is very difficult to carry out all these operations on the shunting sidings, and it is for this reason that I suggest we do not recommend departure direct from the shunting sidings.

**Mr. Wasiutynski** (in French). — I would like to ask the reporter whether, in his report, he comprises hump yards in the term « yards arranged on the level ».

**Mr. Simon-Thomas** (in French). — In yards which are entirely on a gradient, there must be departure sidings following the shunting sidings; and, between the two, there is always a small group of tracks for sorting according to destination and small correction sidings. Yards of this description are to be found particularly in Sweden, Czechoslovakia and Germany.

**Mr. Wasiutynski** (in French). — The sidings for sorting according to destination do not always follow after the shunting sidings.

**Mr. Simon-Thomas** (in French). — Yes, in yards on a continuous gradient they always do. •

**Mr. Wasiutynski** (in French). — I consider that the final clause, beginning with the words : « unless the density of traffic », is not necessary.

**The President** (in French). — The first question to be settled is that raised by Mr. Pretorian, who considers that



departure from the shunting sidings is not desirable, contrary to the opinion of the special Reporter.

**Mr. Pretorian** (in French). — Our object is to make recommendations for the benefit of those who will have to construct shunting yards. If, then, we say that departure direct from the shunting sidings is to be recommended, we shall be over-emphasizing this arrangement.

**Mr. Lamalle** (in French). — I agree with Mr. Pretorian. The working conditions on the Belgian Railways are the same as those on the Roumanian Railways. In Belgium, however, when the marshalling is completed without interruption, trains may leave direct from the shunting sidings, and, consequently, I do not see why we should not stick to the wording proposed by the special reporter.

**Mr. Pretorian** (in French). — I consider that the recommendation is a little too precise.

**The President** (in French). — Would you like us to say : « whenever possible » ?

**Mr. Pretorian** (in French). — I would prefer that the article be omitted altogether.

**The President** (in French). — We may say, then : « In yards arranged on the level, departure direct from the shunting sidings is advisable wherever this is possible » Mr. Wasjutynski proposes the deletion of the remainder.

**Mr. Payet** (in French). — I cannot vote for this proposition, for the closing section of No. 15 refers to an arrangement which there is an increasing tendency to adopt in yards which have a large output.

I am, therefore, in favour of adopting the text proposed by the special reporter,

with the addition of the words read out by the president. I would prefer, however, to change the word « circulation ».

Circulation is the output of the yard, and it would be preferable, therefore, to say : « ...unless the output of the yard is so considerable as to... etc. » That is more precise.

**Mr. Maison** (in French). — Why should we not adopt the English term : « density of the traffic » ?

**Mr. Payet** (in French). — I agree.

**The President** (in French). — The paragraph will read, then, as follows :

« In yards arranged on the level, departure direct from the shunting sidings is advisable wherever this is possible, unless the density of the traffic requires the transfer of trains to groups of departure sidings immediately after marshalling. »

— Adopted.

« 17. The number of connecting tracks between the shunting sidings, sorting sidings and departure sidings, as well as the number of groups of sorting sidings necessary for easy working, depends on the number of trains to be made up, and on the instructions relating to their make-up. »

**Mr. Payet** (in French). — I think this point might be omitted; its suggestion is self-evident to anyone connected with the working of shunting yards. (Agreed.)

— No. 17 is deleted.

**The President** (in French). — « 18. In yards constructed on a continuous gradient the groups of sorting sidings follow the group of shunting sidings. In yards

on the level, with humps, the most practical arrangement of the sorting sidings is alongside the shunting sidings or between the ends of the tracks of this group.»

**Mr. Wasiutynski** (in French). — The words at the end : « or between the ends of the tracks of this group » are not very clear.

**Mr. Pretorian** (in French). — I am of the same opinion, and I suggest their deletion. (*General agreement.*)

**The President** (in French). — No. 18, as amended, is adopted.

« 19. An arrangement of the group of sorting sidings on a down gradient has advantages, and increases the output of the yard. »

— Adopted.

« 20. The number of tracks in a group of sorting sidings, generally from 12 to 14, depends on the instructions relating to the make-up of those trains that comprise the greatest number of destinations. An effective length of 200 m. (220 yards) is sufficient for these tracks; a group of sidings with access at both ends is preferable to a group of dead-end sidings. »

**Mr. Renard** (in French). — It is going too far to say that an effective length of 200 m. (220 yards) is sufficient for the tracks of the sorting sidings. It may be more convenient to have still longer sorting sidings, as for example when the majority of the trains sorted have to leave more or less at the same time.

This allows of the following procedure being adopted : instead of separating the elements of the different trains, all the elements which are to make up the first batch of one or other of the trains are

run on to a splitting-up track, and all the elements for the second batch of such train on to a second track, etc... When sorting, the wagons on the first track are first split up, thus separating the first batches for each of the trains; then the contents of the second track are similarly split up, and the second batches are sent directly to join the corresponding first batches. In this way the trains are completely marshalled without the necessity for any shunting movements. This procedure, however, is only possible if the sorting lines are long enough to hold a complete train.

**The President** (in French). — **Mr. Renard** proposes to say that the tracks of sorting sidings may with advantage be longer than 200 m. (220 yards).

**Mr. Moutier** (in French). — We might say « an effective length of 200 m. (220 yards) appears sufficient ».

**The President** (in French). — I think it would meet the various points put forward if we worded it as follows :

« The number of tracks in a group of sorting sidings, generally not exceeding from 12 to 14, depends on the instructions relating to the make-up of those trains that comprise the greatest number of destinations. An effective length of 200 m. (220 yards) is generally sufficient for these tracks. »

**Mr. Maison** (in French). — That is correct.

**The President** (in French). — And we might add, in order to satisfy **Mr. Renard** :

« In certain cases, however; it may be an advantage to have sorting tracks which will hold a complete train. »

Mr. Wasiutynski (in French). — This addition is not necessary.

Mr. Payet (in French). — That is shunting in two operations; that is not sorting at all.

Mr. Maison (in French). — Let us say merely that a length of 200 m. (220 yards) is generally sufficient.

The President (in French). — Do you insist, Mr. Renard?

Mr. Renard (in French). — No, Sir.

The President (in French). — Your remarks will be recorded in the shorthand notes of our discussions.

I now propose the following wording :

« The number of tracks in a group of sorting sidings, generally not exceeding from 12 tot 14, depends on the instructions relating to the make-up of those trains that comprise the greatest number of destinations. An effective length of 200 m. (220 yards) is generally sufficient for these tracks. A group of sidings with access at both ends is preferable to a group of dead-end sidings. »

— Adopted.

The President (in French). — We will now take No. 21 :

« 21. — In yards constructed on a continuous gradient, it is necessary to arrange a small group of correction sidings, placed between the sorting group and the departure group of sidings. A group of this kind appears to be equally desirable at the end of a sorting group of sidings having a down grade. »

Mr. Wasiutynski (in French). — « It is necessary » is rather too strong, it would be better to say « it is desirable ».

The President (in French). — Let us say « it is useful ». (*Assent.*)

— Article 21, thus amended, is adopted.

« 22. — The use of strong and new material for the construction of groups of shunting and sorting sidings is essential.

Mr. Payet (in French). — I propose the deletion of this article.

Mr. Maison (in French). — I second that.

The President (in French). — Are we agreed to delete No. 22. (*General assent.*)

— Article 22 is deleted.

« 23. The groups of departure sidings should serve as standing room for the trains that have been made up and are awaiting the time for their departure. They should also exercise a regulating function in case of disturbance of traffic on the main lines. The number of departure tracks depends on these two functions, and account must be taken of the possibility of trains leaving the shunting sidings direct. »

Mr. Pretorian (in French). — I propose that we use the words « Les faisceaux de départ », and, in the second clause, « Le nombre de voies de départ », instead of « faisceau de sortie » and « voies de sortie ».

The President (in French). — I think we can agree to this modification. Moreover, in the English text the word « departure » is used. (*Assent.*)

— Article 23, thus amended, is adopted.

« 24. If goods trains are fitted with an automatic compressed air brake, the



departure tracks should be provided with a supply pipe connecting to a compressor, to allow the air brakes to be tried on all wagons before the train leaves the station. If any of the sorting sidings serve also as departure sidings, they should be similarly equipped. »

Mr. Pretorian (in French). — On what railways is such a system to be found?

Mr. Simon-Thomas, *Special Reporter* (in French). — In America, in Germany and in Sweden.

Mr. Pretorian (in French). — Is each wagon tested, or only the whole train when made up?

Mr. Simon-Thomas (in French). — The complete train.

Mr. Pretorian (in French). — You say in your report that each wagon is tested. This considerably prolongs operations.

Mr. Moutier (in French). — Experience on this point is not sufficiently ripe for us to draw a definite conclusion.

Mr. Wasiutynski (in French). — Let us make the wording less imperative.

The President (in French). — We could confine ourselves to stating that in countries where goods trains are fitted with compressed air brakes, the departure tracks are provided with a supply pipe connecting to a compressor to allow of the brakes being tested before departure.

Mr. Payet (in French). — I am in favour of the suggested wording, which leaves the question open for countries which do not adopt this system.

Mr. Simon-Thomas (in French). — Replying to the question put forward by

Mr. Pretorian a few moments ago, I may say that the American reporter, Mr. Wagner, states that the brake test is carried out on each wagon.

Mr. Pretorian (in French). — It is an exceedingly long process.

Mr. Lamalle (in French). — I consider that the brakes should be tested on the train as a whole, and that there can be no question of testing them on each wagon separately.

The President (in French). — I do not think we can discuss this question. America is the only country which adopts this system.

Mr. Lamalle (in French). — Germany also.

The President (in French). — Let us merely note the fact.

Mr. Wasiutynski (in French). — In Poland certain goods trains are fitted with compressed air brakes, and we do not adopt the testing system contemplated by the reporter.

Mr. Trench. — In order to meet the objection of the Polish delegate, I propose that we say : « In certain countries... »

Mr. Maison (in French). — We have not sufficient information on this question. I propose that we delete the article.

Mr. Lamalle (in French). — I am against the deletion of the article, as I consider that we ought to record the progress effected in all countries, whatever they are. The practice in Germany is to test the brakes of the train as a whole and not only of the individual wagons.

The President (in French). — The American report states that each wagon

is tested, which is the same as stating that the complete train is tested.

He reads the text as finally proposed :

« 24. — In certain countries where goods trains are fitted with an automatic compressed air brake, the departure tracks are provided with a supply pipe connecting to a compressor to allow of the brakes being tested before the train leaves the station. »

**Mr. Maison** (in French). — It must be made clear that we are merely making a statement of fact in this article, and not a recommendation.

— No. 24 is adopted.

**The President** (in French). — « 25. — In yards which have to provide for through trains and semi-through trains overtaking others, it is necessary that groups of lie-by sidings specially reserved for this purpose should be provided.

« The most rational arrangement for the tracks with a view to the uncoupling of sets of wagons, is alongside the group of arrival sidings. »

**Mr. Moutier** (in French). — It would be desirable to allow more latitude as to the position of the tracks from the point of view of the splitting-up. There are cases in which it is not altogether desirable to place the passing sidings alongside the arrival sidings, and in which, indeed, it is preferable to place them after. I propose, therefore, that we delete paragraph 2.

**The President** (in French). — I wish to suggest a slight modification of form. The wording is : « ...il ne faut jamais oublier d'établir... » That appears to me superfluous : it is as if one said that in building a house one must never forget to put in the staircase ». I think it would

be better to say : « ... il convient d'établir... »

**Mr. Trench.** — The words « It should never be forgotten » do not appear in the English text.

— No. 25, subject to the deletion suggested by Mr. Moutier and the amended wording suggested by the President, is adopted.

**The President** (in French). — « 26. — The number and arrangement of the roads that afford communication between the various portions of the yard are of very great importance. To avoid level crossings, tracks arranged for the independent running of the locomotives may be constructed with a maximum gradient of 1 in 30. »

**Mr. Pretorian** (in French). — I propose the deletion of the final phrase, in view of the fact that the number and arrangement of the communication roads differ in each yard.

**Mr. Simon-Thomas**, (in French). — The phrase in question may be useful, because in many yards the number of communication roads is too small.

**Mr. Pretorian** (in French). — I will not press the point.

— No. 26 is adopted.

**The President** (in French). — « 27. A small group of sidings specially intended for front vans is to be recommended. It should be so arranged that the vans can be easily uncoupled and removed by the main line locomotives. »

**Mr. Moutier** (in French). — Experience has shewn that this small group of sidings is not absolutely necessary, and even that it is often preferable to dispense with it. If you provide a group of sid-

ings, of whatever kind, under the control of a permanent attendant, you are encouraging him to make use of it, and he often does so needlessly and unreasonably.

**Mr. Maison** (in French). — It is a small detail.

**Mr. Moutier** (in French). — Which is not without importance.

**Mr. Lamalle** (in French). — We might say : « Certain railways provide a small group of sidings specially reserved for front vans. »

**Mr. Pretorian** (in French). — When a train arrives on the group of sidings and the locomotive is taken off, the latter almost always takes away the front van, which it drops at the proper spot. It is therefore important that there should be a small group of sidings for holding front vans.

**Mr. Wasiutynski** (in French). — Instead of saying, in the second sentence, « It should be so arranged... » I consider it would be better to say : « It is an advantage to arrange it in such a way that... »

**The President** (in French). — We are divided between two opposite opinions. Some of us consider it desirable to have a special group of sidings for holding front vans, and others dispute the usefulness of such a group of sidings. It is a question of personal opinion which we must leave unsettled, and I propose the adoption of the text contained in the special report subject to a slight modification. We will say « Certain railways provide a small group of sidings specially intended for holding front vans. »

**Mr. Lamalle** (in French). — In the opinion of the special reporter this group of sidings is useful when vans are at the

front of trains. On certain railways however, and particularly on the Belgian State Railways, the van is at the rear, and in such cases the special group of sidings is unnecessary.

**The President** (in French). — I propose the adoption of the following text :

« Certain railways provide small groups of sidings specially intended for holding front vans. It is advisable that these sidings should be so arranged that the vans can be easily uncoupled and removed by the main line locomotives. »

**Mr. Lamalle** (in French). — The latter half of the paragraph is not necessary.

**Mr. Pellarin** (in French). — It is obvious.

— No. 27 is adopted.

**The President** (in French). — « 28. — In large shunting yards, small coal stages, with water cranes for filling up the shunting locomotives, arranged near the places in which these locomotives usually work, are advantageous. »

— Adopted.

« 29. — The weighbridge should be so arranged that the wagons running over it may again be pushed direct over the splitting-up sidings. »

**Mr. Payet** (in French). — I do not understand why this paragraph has been included in a report relating to shunting yards.

**Mr. Maison** (in French). — This arrangement concerns only the American railways.

**Mr. Moutier** (in French). — The weighbridge is in use in Roumania; it is



of American origin. I have noticed from the plans that in America there are, on the splitting-up gradient, small accessory tracks on to which wagons are switched so that the weight can be recorded as they pass through. I agree that as regards such yards it is advisable to indicate the spot where the weighbridge should be placed but as regards yards which have no weighbridge, the paragraph is misleading.

On the other hand, we might say : « Where a weighbridge is provided, it should be so arranged, etc. » Or again, we might merely delete the paragraph, and this is what I should prefer.

**Mr. Lamalle** (in French). — I support the deletion of the paragraph, because on European railways the weighing is done before departure in order to give the dispatcher and consignee the means of exercising control. This control cannot be effectively exercised when the weighing is done in the shunting yards.

**The President** (in French). — The special reporter points out to me that there are weighbridges in Germany and Holland.

**Mr. Lamalle** (in French). — In shunting yards?

**Mr. Andreae**, Swiss Federal Railways Department (in French). — Weighbridges are necessary in frontier stations. At the Swiss frontier wagons are weighed on entering.

**Mr. Descubes** (in French). — I propose that we say : « ... so that the wagons weighed can be pushed direct over the splitting-up points. » At Altoona I found that the weighbridge was placed in front of the hump, and the whole train passed over the weighbridge. My suggestion amounts to deleting the word « again ».

**Mr. Andreae** (in French). — I second that proposal.

— No. 29, as amended, is adopted.

**The President** (in French). — « 30. — The construction of repair shops for rolling stock near the shunting yard, having regard to the situation of the shunting yard relatively to the rest of the railway system, may be of advantage. »

**Mr. Wasiutynski** (in French). — The first two lines appear to me superfluous. Is the reference to main repair shops? I assume that it is not. As regards auxiliary repair shops, it is always desirable that they should be installed near to shunting yards, whatever be the location of the latter in relation to the railway system.

I propose, therefore, that we say :

« It is advantageous to provide repair shops for rolling stock in proximity to shunting yards. »

**Mr. Lamalle** (in French). — Mr. Wasiutynski's remarks are perfectly justified. What are required in the vicinity of shunting yards are auxiliary repair shops. The location of the main repair shops depends on considerations connected with the traction service rather than with the operating service.

**Mr. Pretorian** (in French). — Let us say : « shops for minor repairs ».

**Mr. Payet** (in French). — Or « ordinary maintenance repairs ».

**Mr. Descubes** (in French). — It is an advantage to be able to carry out larger repairs also. Moreover, each railway must make the arrangements which it considers most suitable.

**The President** (in French). — I pro-

pose, gentlemen, that we say : « It is desirable to provide repair shops for rolling stock in proximity to shunting yards. »

This wording admits of the various interpretations referred to in the discussion.

— This text was adopted.

« 31. — In most cases, the traffic organisation, particularly at large junctions, requires the addition of transshipment installations at shunting yards. In yards with a single group of shunting sidings, the most rational position is obtained by lengthening the group of shunting sidings. In yards having separate shunting sidings for each of the two directions of traffic, the most practical site for the transshipment installation appears to be the centre of the yard. »

**Mr. Moutier** (in French). — What is comprised in the term « transshipment installations »? I take it that we are referring to small goods.

**Mr. Lamalle** (in French). — Is the reference to the transshipment of goods wrongly loaded?

**Mr. Maison** (in French). — Transshipment sheds are meant.

**Mr. Simon-Thomas** (in French). — It is a question of the transshipment of small goods.

**Mr. Moutier** (in French). — I should prefer a more precise explanation as to the manner in which these installations are arranged.

**Mr. Payet** (in French). — The wording should be : « transshipment of small goods », and the meaning will then be perfectly clear.

**The President** (in French). — Mr. Trench has just pointed out to me that it

is not necessary to alter the English text. As regards the French text we can say : « Installations de transbordement des marchandises de détail ». (*Agreed.*)

**Mr. Wasiutynski** (in French). — We are asked to say that in yards which have a single group of shunting sidings, the most rational position for the transshipment installations is obtained by lengthening the group of shunting sidings. I consider, however that these installations may conveniently be placed alongside the shunting sidings or in the sidings themselves.

**Mr. Lamalle** (in French). — I am of the same opinion as the Polish delegate.

**Mr. Maison** (in French). — The words « the most rational » should be deleted.

**Mr. Descubes** (in French). — It is not necessary to give such precise suggestions as that. It depends on the tracks available and on topographical considerations.

**Mr. Pretorian** (in French). — I think the wording is satisfactory because, if exit from the shunting sidings is by means of a curve, it is still a prolongation of those sidings, even if the transshipment takes place alongside.

**The President** (in French). — If, in practice the various solutions are to be found, it will be better to delete the phrase.

**Mr. Wasiutynski** (in French). — I propose the deletion of the sentence concerning yards which have a single group of sidings, and the retention of that which contemplates yards which have separate shunting sidings for each direction of traffic.

It is, in fact, certain that in the latter case the centre of the yard is the most

suitable position; but in yards with a single group of sidings, the situation depends on local circumstances.

Mr. Maison (in French). — The text proposed by the reporter regarding yards with a single group of sidings cannot stand if the words « the most rational » are used, because there is often insufficient space available, and it is the space available which must determine the arrangement to be adopted.

Mr. Payet (in French). — I am in agreement with Mr. Wasiutynski's proposition. We should delete the sentence relating to yards with a single group of sidings, and retain the other sentence. In the first case the situation depends entirely on local circumstances.

Mr. Ferreira, Portuguese Railways Company (in French). — The most suitable site is obviously furnished by the lengthening of the shunting sidings, but it may happen that local circumstances do not permit of this solution. I propose, therefore, that we say : « The site which most commends itself is afforded by the lengthening of the shunting sidings. »

The President (in French). — Several amendments have now been proposed. I will first put to the vote the most radical of them, which consists in deleting the sentence relating to yards with a single group of sidings.

Mr. Pellarin (in French). — I am in favour of deleting the last sentence also, for there are cases in which it is not possible to place the transshipment sheds in the centre of the yard. It may be necessary, even in a yard which has separate shunting sidings for the two directions of traffic, to select the same site as would

be selected if the yard had only a single group of sidings.

The President (in French). — I think the majority of the members are in favour of retaining the last sentence.

I propose that we say that the centre of the yard *is generally the most practical site*, instead of saying that it *appears* the most practical. (*Assent.*)

The sentence relating to yards with a single group of sidings will be deleted. (*Renewed assent.*)

— The article, thus amended, is adopted.

« 32. — Transshipment is effected in most of the yards by means of hand trolleys. It is only in yards in which the transshipment installations are very large, or in those comprising warehouses with several parallel platforms, that handling by means of tractors and electric runabouts may have advantages. »

Mr. Payet (in French). — I propose the deletion of this article, which relates to utilisation of the various means of transshipment but has no direct bearing on the question of shunting yards.

Mr. Moutier (in French). — I support Mr. Payet's proposition. This question has nothing to do with the one we are discussing.

Mr. Payet (in French). — It might usefully form the subject of discussion at a future session of the Congress, for it is of interest, but we have no reason to discuss it at the moment. (*General assent.*)

The President (in French). — We will delete this article then, and the secretariat will inform the Permanent Commission that certain members desire to see



it brought up at the next session of the Congress.

— Article 32 is deleted.

« 35. — From the point of view of economy, it is necessary to keep a careful check, based on daily records and statistics under definite heads, on the working of the shunting sidings. »

Mr. Payet (in French). — This suggestion has no particular connection with the question of shunting yards. It is rather a question arising out of the subject of statistics, and I propose that No. 35 be deleted.

Mr. Wasintynski (in French). — It appears to me desirable that the Congress should make a recommendation with regard to shunting yard statistics, but we should modify the wording, and say : « It is recommended that statistics be kept on all questions relating to shunting yards. »

The President (in French). — There is a proposition that we delete No. 35. I propose to state, in order that it may be recorded in the minutes, that the section has deleted the last paragraph of No. 33 and the whole of Nos. 34 and 35 because it does not consider that they relate specially to shunting yards. (*Assent.*)

Mr. Lamalle (in French). — There is also a section of the Congress which is dealing with the question of statistics.

The President (in French). — Mr. Andrae has an observation to make with regard to No. 31. We will therefore return to that article.

Mr. Andrae (in French). — I desire simply to propose the addition of the fol-

lowing paragraph : « In frontier stations, customs houses should be connected with the shunting yard. »

The President (in French). — If there is no opposition to this, the suggested paragraph will be added to No. 31.

Mr. Descubes (in French). — I propose the addition of a new article worded as follows :

« In order to economise staff, increase the rate of splitting-up wagons, and avoid errors, it is advisable that the points at the head of the sidings should be controlled from central cabins; these cabins control the points either by means of wires or hydraulic power. Certain systems include safety pedals which prevent the movement of switches under the wheels of the wagons; use is also made of semi-automatic apparatus which allows the shunter to work with one movement all the points giving access to one shunting line, the points moving on the approach of wagons. »

Capt. Gordon. — I think we have left out a very important point, and that is the traffic control. I think the traffic control centres should be located in these yards, and that the yardmaster should also be the head controller of that control panel, so that the man in charge of the yard will be responsible for the incoming trains, and the despatching of trains, in addition to the breaking up of the trains in the yard.

The President (in French). — This question has to do with the dispatching system, and might usefully be considered by section III.

Capt. Gordon. — But, unfortunately, many people do not realise that marshall-

ing yards are not also holding yards, and therefore the traffic officer is always sending in trains quite irrespective of the speed at which trains are being got out, and a block occurs in the yard. If the man responsible for the traffic of the division is actually located in the yard, it makes all the difference to the working of the yard.

**Mr. Pellarin** (in French). — On the Eastern Railway of France they have some such organisation, but, as the President has just pointed out, this question arises under the dispatching system.

**The President** (in French). — If it is necessary, after the third section has discussed the question of the dispatching system, for us to have a further joint

meeting with the first section to come to a decision with regard to the question raised by Capt. Gordon I will request Mr. Trench to arrange for such further meeting.

**Mr. Gaeremynck** (in French). — Mr. President, I notice that Mr. Simon-Thomas has said nothing in his report about arrival tracks in marshalling yards. This question is, however, a very important one.

**The President** (in French). — We can consider that question when discussing the dispatching system.

**Mr. Gaeremynck** (in French). — Thank you.

— The meeting closed at 12.30 p. m.

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# DISCUSSION AT THE GENERAL MEETING

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Meeting held on 27 June 1925 (morning).

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PRESIDENT : THE RIGHT HON. VISCOUNT CHURCHILL.

GENERAL SECRETARIES : SIR HENRY FOWLER and Mr. P. GHILAIN.

Sir Henry Fowler, *General Secretary*, read the final summary adopted by the 1st and 3rd sections meeting jointly.

Mr. Simon-Thomas, *Special Reporter*, (in French). — Gentlemen, as regards article 12, I wish to point out that there is a marked difference between the different braking methods, as I stated in my report.

Up to the present we have been content on the Continent with the slipper-brake, particularly the model produced by Bussing & Co., which is used on a large scale in Denmark, Sweden, Switzerland, Czechoslovakia and Germany, and which was developed into an automatic brake in France in 1924.

At the present day, however, we have entirely different systems of braking, in which the retarding action is exercised by means of check rails arranged on the inside and outside of the track rails. A track brake of this kind is that of Mr. Hannauer, used in the Gibson yard of the Indiana Railroad in America. Other systems are mentioned in my report.

I think, gentlemen, that we ought to point out that these systems of braking are to be recommended, and I propose the following wording for article 12. :

« 12. — It must be possible to reduce the speed of wagons when required; with

this object various systems are in use; among them may be noted the scotch block, automatic or non-automatic, the system of braking by means of check rails, automatic or non-automatic, acting according to the weight of the wagons, etc. » -

— Article 12, thus modified, is adopted.

Mr. Pretorian (in French). — I think there is a slight error in article 13. This article says : « It is desirable to reduce to a minimum the distance between the top of the hump and the set of points nearest to the head of the sidings. » The wording decided upon was as follows : « The distance between the top of the hump and the set of points... »

The President. — Here is the text proposed for article 12 :

« The speed of wagons must be reduced when required. For this there are different braking methods in use, among which may be mentioned the scotch block, automatic and non-automatic, and methods of braking by means of check rails, automatic or non-automatic, which are dependent upon the weight of the wagons. »

Mr. Moutier proposes to add « , etc. », in order to make the wording less restrictive.

— The article, thus amended, is adopted.



The President. — We will now settle article 15.

Sir Henry Fowler, *General Secretary*. — The following is the text as proposed by Mr. Pretorian :

« It is desirable that the distance between the points at the head of the sidings and the fouling point should be as short as possible, and as near as possible the same for all the tracks. »

— This wording was put to the vote and adopted.

The President. — The Final Summary is as follows :

#### Final summary.

« 1. — Sorting and marshalling yards enable traffic to be conducted more rapidly and increase the traffic capacity of the lines as well as the circulation of rolling stock.

« These yards are placed at centres in which the traffic is sufficiently dense to necessitate distribution over the different routes, especially at communication points.

« The lay-out depends on the organisation of traffic into through, semi-through and stopping trains as required by the extent and distribution of the traffic.

« 2. — The length of these stations may amount to 5 km. (3 miles). They comprise in general arrival sidings, sorting sidings and, fairly frequently, marshalling sidings, sidings for making up according to destination, sidings for trains waiting for departure and transshipment sheds.

« Finally, the installation is completed by a wagon repair section, a locomotive

shed and, if required, a disinfecting yard.

« 3. — From the point of view of the use of gravitation for shunting, the sidings can be established according to local conditions and the configuration of the ground, either on a continuous gradient or on the level with a hump. In the former category are included sidings in which the total incline is continuous, and sidings partially inclined, particularly in the case of reception sidings and those for marshalling according to destination. In the latter case it is desirable to be able to perform the operations by means of locomotives in cases where, as a result of unfavourable atmospheric conditions, the working of the group of arrival sidings is not satisfactory.

« Sidings on a continuous slope do not appear advisable except in cases where the ground offers a natural slope.

« 4. — A group of shunting sidings for each direction of traffic is advisable when the traffic in each direction is more or less independent of the other; otherwise a single group of sidings is preferable. This is also the case when the number of wagons to be split up daily does not exceed the capacity of the splitting-up point.

« 5. — It is necessary that the number of reception tracks be such that they can receive trains on arrival so as to avoid congestion on the main line, and it is also necessary to provide for the simultaneous entrance of trains arriving by different lines.

« The length of the reception lines should be sufficient to take the longest trains. When the topographical conditions permit, the most practical solu-

« tion consists in placing these lines immediately in front of the hump.

« 6. — The preliminary operations for splitting-up the trains, which vary according to the arrangement of the yard and the traffic to be handled, should be carefully arranged so as to occupy the shortest time possible. This condition becomes most essential in winter owing to the increased rolling resistance arising from the cooling of the oil in the axle-boxes.

« 7. — During the operation of splitting-up the trains the indication of the particular sidings given to the pointman, and where necessary to the rest of the shunting staff, must be given in a clear and simple manner equally capable of being worked by day, night, or during fog. Methods vary according to circumstances.

« Among the various systems the following may be noted as particularly interesting : shunting tickets; electric push buttons at the hump with electric board in the cabin; the use of loud-speaking telephones and luminous signals. »

« 8. — If it is necessary to have a shunting engine, communication between the driver of the shunting engine and the foreman shunter and pointman should be such that the orders given by the shunter can be carried out immediately by the driver.

« Among the various systems the following may be noted : luminous signals, and electric bells in the cab of the engine, etc.

« 9. — It is necessary to design the hump or the grade at the splitting-up sidings as accurately as possible, taking account of the various resistances that

« affect the running of the wagons as they come over.

« The influence of the wind resistance being considerable, the splitting-up sidings should, where possible, be arranged in the most favourable direction in relation to the prevalent winds.

« 10. — The radius of curvature of the top of the hump in vertical section should be at least 200 m. (10 chains).

« 11. — The height of the hump or the gradient of the continuous slope should be such that all the wagons, whatever their running conditions, attain sufficient speed to reach their correct destination on the shunting lines. This result ought to be obtained even under unfavourable atmospheric conditions. The speed should, moreover, be such that when the points are reached the wagons have sufficient interval between them.

« 12. — It must be possible to reduce the speed of wagons when required; with this object various systems are in use; among them may be noted the scotch block, automatic or non-automatic, the system of braking by means of check rails, automatic or non automatic, acting according to the weight of the wagons, etc.

« 13. — The construction of a hump having two different levels is only necessary if a hump with a single level, designed to deal with traffic under the most unfavourable conditions, does not permit of stopping the wagons when circumstances are favourable.

« 14. — It is usually advisable to have loops round the hump, and sometimes a special dead-end siding for the shunting engine used for moving wagons which have stopped on the sidings.



« 15. — The distance between the top  
« of the hump and the set of points  
« nearest to the head of the sidings  
« should be as short as possible. The  
« lay-out of the head of the sidings should  
« be such that there is no great difference  
« between the resistances offered by the  
« different tracks, and that the distance  
« between the points at the head of the  
« sidings and the fouling point should  
« be as short as possible, and as near as  
« possible the same for all the tracks.

« If necessary, the head of the sidings  
« can be given a sufficient incline to  
« overcome resistances due to curves and  
« reverse curves.

« 16. — In order to economise staff,  
« increase the rate of splitting-up wagons,  
« and avoid errors, it is advisable that the  
« points at the head of the sidings should  
« be controlled from central cabins; these  
« cabins control the points either by  
« means of wires or fluid pressure. Cer-  
« tain systems include safety pedals which  
« prevent the movement of switches  
« under the wheels of the wagons; use is  
« also made of semi-automatic apparatus  
« which allows the shunter to work with  
« one movement all the points giving  
« access to one shunting line, the points  
« moving on the approach of wagons.

« 17. — The number of tracks in the  
« shunting sidings depends upon the  
« traffic to be handled (density of traffic,  
« number of directions, supplementary in-  
« stallations, etc.) and on the instructions  
« relating to the make-up of goods trains.  
« In determining this number, account  
« must be taken of the maximum possible,  
« that is, 35 to 40 for level yards with  
« humps. It must not, however, be over-  
« looked that the addition of sidings for  
« some supplementary routes may appre-  
« ciably facilitate the make-up of semi-  
« through trains.

« The effective length of the shunting  
« sidings depends on the maximum length  
« adopted for the trains, and must be  
« sufficient to allow, where necessary, of  
« effecting sorting operations at the head  
« of the sidings opposite the splitting-up  
« point; it is supplemented by a certain  
« length corresponding to the distance  
« necessary for stopping the last wagons.

« In yards arranged on a continuous  
« gradient it is necessary that the slope  
« of the shunting sidings should be at  
« least 1 in 200, in order that the sets  
« of wagons may start running under  
« the action of gravity alone.

« 18. — In yards arranged on the level,  
« departure direct from the shunting  
« sidings is advisable wherever this is  
« possible, unless the density of the  
« traffic requires the transfer of trains  
« to groups of departure sidings imme-  
« diately after marshalling.

« 19. — In yards constructed on a  
« continuous gradient, the groups of  
« sorting sidings follow the group of  
« shunting sidings; in yards on the level  
« with humps, the most practical arrange-  
« ment of the sorting sidings is alongside  
« the shunting sidings.

« 20. — An arrangement of the group  
« of sorting sidings on a down gradient  
« has advantages, and increases the out-  
« put of the yard.

« 21. — The number of tracks in a  
« group of sorting sidings, generally  
« not exceeding from 12 to 14, depends on  
« the instruction relating to the make-up  
« of those trains that comprise the great-  
« est number of destinations. An effec-  
« tive length of 200 metres (220 yards)  
« is generally sufficient for these tracks.  
« A group of sidings with access at both  
« ends is preferable to a group of dead-  
« end sidings.



« 22. — In yards constructed on a continuous gradient, it is useful to arrange a small group of correction sidings, placed between the sorting group and the departure group of sidings. A group of this kind appears to be equally desirable at the end of a sorting group of sidings having a down grade.

« 23. — The groups of departure sidings should serve as standing room for the trains that have been made up and are awaiting the time for their departure. They should also exercise a regulating function in case of disturbance of traffic on the main lines.

« The number of departure tracks depends on these two functions, and account must be taken of the possibility of trains leaving the shunting sidings direct.

« 24. — In certain countries where goods trains are fitted with an automatic compressed air brake, the departure tracks are provided with a supply pipe connecting to a compressor to allow of the brakes being tested before the train leaves the station.

« 25. — In yards which have to provide for through trains and semi-through trains overtaking others, it is necessary that groups of lie-by sidings specially reserved for this purpose should be provided.

« 26. — The number and arrangement of the roads that afford communication between the various portions of the yard are of very great importance. To avoid level crossings, tracks arranged for the independent running of the locomotives may be constructed with a maximum gradient of 1 in 30.

« 27. — Certain railways provide small groups of sidings specially intended for holding front vans. It is advisable that these sidings should be so arranged that the vans can be easily uncoupled and removed by the main line locomotives.

« 28. — In large shunting yards, small coal stages, with water cranes for filling up the shunting locomotives, arranged near the places in which these locomotives usually work, are advantageous.

« 29. — Where a weighbridge is provided, it should be so arranged that the wagons running over it can be pushed direct over the splitting-up points.

« 30. — It is desirable to provide repair shops for rolling stock in proximity to shunting yards.

« 31. — In most cases, the traffic organisation, particularly at large junctions, requires the addition of transshipment installations at shunting yards. In yards having separate shunting sidings for each of the two directions of traffic, the most practicable site for the transshipment installation is generally in the centre of the yard.

« In frontier stations, customs houses should be connected with the shunting yard.

« 32. — The arrangement of the locomotive shed and the organisation of its supplies are of great importance. It is necessary that the connections between the locomotive shed and other parts of the yard should be conveniently arranged and sufficient in number. »

— The above Final Summary was adopted by the General Meeting.

